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TAXONOMIC OVERVIEW OF *STEMODIA* (SCROPHULARIACEAE) FOR NORTH AMERICA AND THE WEST INDIES

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ABSTRACT

A taxonomic study of the species of *Stemodia* occurring in North America and the West Indies is rendered. Seventeen species are recognized as native within this region. These include *Stemodia angulata*, *S. bartsioides*, *S. chiapensis*, *S. coahuilensis*, *S. durantifolia*, *S. fruticosa*, *S. jorullensis*, *S. lanata*, *S. macrantha*, *S. maritima*, *S. multifida*, *S. palmeri*, *S. peduncularis*, *S. pusilla*, *S. schottii*, *S. tenuifolia*, and *S. verticillata*. Except for *Stemodia coahuilensis* and *S. multifida*, which are currently under revision by David Keil as part of his concept of the genus *Leucospora*, a key to species, descriptions, distributional maps, and complete synonymy for each of these is provided. One new species, *Stemodia chiapensis* B.L. Turner, is proposed. The genus *Leucospora* is treated as part of *Stemodia* (s.l.) but *Schistophragma* is retained. This has necessitated the following new combinations: *Schistophragma polystachya* (Brandegee) B.L. Turner and *Stemodia coahuilensis* (Henr.) B.L. Turner.

KEY WORDS: Scrophulariaceae, *Leucospora*, *Schistophragma*, *Stemodia*

Stemodia belongs to the family Scrophulariaceae, subfamily Antirrhinoideae, tribe Gratiroleae, where it has been variously accepted, either as a rather large, highly variable genus *Stemodia* (s.l.) or as a less diverse, somewhat smaller genus *Stemodia* (s.s.). Most early workers more or less took the former stance (e.g., Bentham 1886; Wettstein 1891) but Minod (1918), in his revisionary study of the New World taxa, drastically reoriented taxonomic concepts or attitudes on the group by recognizing a monotypic *Stemodiaca* (typified by *Stemodia maritima* L.), an older name for *Stemodia*. *Stemodia*, however, was subsequently conserved over *Stemodiaca*. Minod also segregated out of his

Stemodia complex, four newly erected monotypic genera (*Chodaphyton*, based upon *Stemodia ericifolia* [Kuntze] Hassler; *Lindernia*, based upon *Stemodia verticillata* (Miller) Hassler; *Valeria*, based upon *Stemodia trifoliata* [Link] Reichenbach [= *Stemodia pratensis* (Aublet) C. Cowan of the present treatment]; and *Verena*, based upon *Stemodia hassleriana* Chodat). He retained most of the remaining New World taxa of *Stemodia* (s.l.) in his concept of *Stemodia*. So treated, he recognized 31 species of *Stemodia* as occurring in the New World, thirteen of these occurring in the Americas north of South America.

Most subsequent workers (e.g., Barroso 1952; Dawson 1974; D'Arcy 1979; Seymour 1976; Standley & Williams 1973) have continued to treat *Stemodia* in the broad sense, keeping in it most of the monotypic segregates proposed by Minod. We also subscribe to the wider view, with the exception that the Cuban species, *Stemodia radicans* Griseb., which was retained by Minod in *Stemodia*, is accepted as belonging to the genus *Cheilophyllum*, as first proposed by Pennell (1935). In addition, we include in *Stemodia* the genus *Leucospora*, which most recent workers have treated as distinct. Since Keil (in prep.) is currently revising *Leucospora* (including *Schistophragma*) we have not treated in detail, nor mapped, species of the latter.

We have also separated from *Stemodia* three recently described closely related species, *S. reliquiarum* D'Arcy, *S. mutisii* Fernández-Alonso, and *S. costaricensis* B.L. Turner, positioning these in a newly erected genus *Darcya* (Turner & Cowan 1993).

In summary, the present treatment recognizes seventeen species of *Stemodia* (s.l.) as native in the New World north of South America. (A single record of *S. pratensis* from Trinidad is believed to be a recent introduction from the mainland of South America). Approximately nineteen species are recognized for South America, but these will be treated in a subsequent account (Turner & Cowan 1993). In addition, some ten to fifteen species are native to the Old World (including those in the recently submerged genus *Morgania* R. Br. (cf. Barker 1981), which we do not intend to treat.

CHROMOSOME NUMBERS

Chromosome counts for two New World species of *Stemodia* have been reported, these being $2n = 44$ for *S. multifida* (Keil, pers. comm.) and $2n = 22$ for *S. verticillata* (Fedorov 1974; reported as *S. parviflora* W.T. Aiton). An additional Old Word species, *Stemodia viscosa* Roxb. has been reported as $2n = 28$ (Subramanian & Pondmudi 1987) and $2n = 42$ (Fedorov 1975).

If these numbers prove correct, the genus (s.l.) is likely to prove dibasic or perhaps multibasic, with numbers of $z = 11$ and $z = 14$ (if not $z = 7$). Clearly, additional counts in the genus are sorely needed.

GENERIC CONSIDERATIONS

As already noted, *Stemodia* has been variously treated, usually in the broad sense, but Minod (1918) retained but a single species in the now conserved genus *Stemodia* (typified by *S. maritima*), which he called *Stemodiaca* P. Br. (1756). So treated, the next available generic name, *Phaelypea* P. Br. (1756) would have to be applied to the 40 or more species that make up *Stemodia* (s.l.). Regardless, if *Stemodia* were treated as monotypic, numerous new combinations under the obscure name *Phaelypea* (which is sufficiently obscure so as not to have been listed in *Index Kewensis*) would have to be made. Indeed, *Stemodia* (s.l.) appears to be a monophyletic assemblage largely composed of species having a syndrome of characters, namely: 1) opposite subpinnate or pinnately veined leaves; 2) flowers axillary or in terminal spikes; 3) calyx with sepals ± alike and separate to the base; 4) corollas mostly lavender to purple, zygomorphic with well developed tubes; 5) anther thecae glabrous, divergent, with swollen connectives, or the thecae shortly stalked; 6) styles at anthesis 2-4 times as long as the stigmatic area; 7) stigmatic area enlarged and usually recurved, bifid; 8) capsule mostly loculicidally 4 valvate, ovoid to orbicular, 1.0-1.5 times as long as wide; 9) seeds pedicellate, ellipsoid to broadly obpyramidal, deeply 8 sulcate or not, the ridges parallel, never spiral, the surfaces variously ornate.

Most of the species of *Stemodia* (s.l.) will contain seven or more of these characters. As conceived here, the closest related taxon to *Stemodia* (s.l.) is the genus *Schistophragma* which is composed of three species, all of these native to México and distinguished by elongate capsules with septicidal dehiscence and seeds with helical grooves, characters which are not found in the 50 or more species of *Stemodia* (s.l.). Beyond *Schistophragma*, the genus most closely related to *Stemodia* (s.l.) might be *Bacopa*, but this is mostly speculative. Clearly, *Stemodia* (s.s.) and its cohorts are in need of detailed character analysis, especially those derived from comparative DNA studies, before drastic generic redispositions are made, if any. It is our personal opinion, however, that *Stemodia* (s.l.) is a monophyletic assemblage whose internal restructuring might best be shown through nomenclatural constructions at the infrageneric level.

CHEMICAL INVESTIGATIONS

Two New World species of *Stemodia*, *S. durantifolia* (L.) Swartz and *S. maritima*, have reportedly been used in herbal medicine by local peoples, at least in Haiti. Because of this, attempts have been made to elucidate any active ingredients in these species. Stemodane triterpenes and yet other compounds

were isolated but none of these appeared to possess especially significant antiviral or cytotoxicity attributes (*cf.* Weniger *et al.* 1982, Hufford *et al.* 1992, and references therein).

TAXONOMY

Stemodia L. (s.l.) 1759, *nom. conserv.*

Cordium Sloane 1707.

Erinus Miller 1731.

Stemodiaca P. Br. 1756.

Phaelypea P. Br. 1756.

Matourea Aublet 1775.

Adenosma R. Br. 1810, not *Adenosma* Nees.

Morgania R. Br. 1810.

Leucospora Nutt. 1834.

Chodaphyton Minod 1918.

Lendneria Minod 1918.

Valeria Minod 1918.

Verena Minod 1918.

Annual or perennial herbs, shrublets or small scrambling shrubs to 3 m high. Leaves opposite or less often verticillate, simple to bipinnately dissected, mostly subpinnately veined. Flowers axillary, arranged (1-)2-4 to a node, often densely clustered along the upper stems forming well defined, usually interrupted, spikes. Sepals 5, ± alike, separate to the base or nearly so. Corollas mostly tubular, white to blue or violet, rarely somewhat yellowish, zygomorphic, lobes usually shorter than the tube, variously pubescent without and within, rarely glabrous, the inner surface near the throat of the tube usually bestowed with elongate hairs with spatulate apices. Anther bearing stamens usually 4, the anther thecae glabrous, not closely adjacent or parallel, usually separated by a swollen or enlarged connective, less often the thecae borne upon well developed stalks. Stylar shaft 2-10 times as long as the enlarged minutely bilobed stigmatic region, the latter usually reflexed, less often erect, or somewhat incurved, rarely markedly bilobed. Capsules ovoid, mostly somewhat longer than wide, glabrous, 4 valvate with usually loculicidal dehiscence. Seeds numerous, ellipsoid to broadly obpyramidal, deeply longitudinally 6-8 sulcate or not, usually to some extent stipitate and variously ornate. Base chromosome numbers, $x = 11$ and 14 (from only 3 species).

Type species, *Stemodia maritima* L.

KEY TO NORTH AMERICAN AND WEST INDIAN
SPECIES OF *STEMODIA*, S.L.

(with the exclusion of *Leucospora*, which has two species both with dissected leaves and both of which belong to *Stemodia* in the senior author's opinion; cf. comments under CONTROVERSIAL AND EXCLUDED NAMES at the end of this paper)

1. Leaves clearly petiolate, the blades tapering upon the petioles to the very base; calyx w/o bracts at the base; seeds deeply 6-8 sulcate. (2)
1. Leaves sessile; calyx with 1 or 2 basal bracteoles; seeds not clearly sulcate. (11)
 2. Suffruticose brittle stemmed herbs, shrublets or shrubs, mostly 0.5-2.0 m high; leaves drying black; Belize, El Salvador, Honduras. *S. fruticosa*
 2. Annual or perennial herbs (rarely suffruticose at base), mostly 0.1-1.5 m high; leaves drying green or greenish; widespread. (3)
 3. Perennial herbs mostly 0.3-1.5 m high. (4)
 3. Annual herbs mostly 0.1-0.3(-0.4) m high. (7)
 4. Pedicels (both flower and fruiting) 1-6 mm long. (5)
 4. Pedicels 10-40 mm long; petioles 8-20 mm long; widespread. (6)
 5. Petioles 1-6 mm long; stems hirsute, the hairs 1 mm long or more; Jalisco, Michoacán, México. *S. tenuifolia*
 5. Petioles 8-20 mm long; stems puberulent, the hairs 0.4 mm long or less; Chiapas. *S. chiapensis*
 6. Leaves markedly punctate beneath with amber colored glands; vestiture of stem mostly 1 mm high or less, and largely devoid of glandular hairs; eastern México (Hidalgo) to Chiapas and southwards to Panamá. *S. peduncularis*
 6. Leaves moderately to inconspicuously punctate beneath with yellow or clear glands; vestiture of stem mostly 1-2 mm high and usually beneath this copiously covered with much shorter glandular hairs; western México (Nayarit) to Chiapas and southwards to Honduras. *S. macrantha*
 7. Leaves markedly glandular punctate beneath; West Indies, Central America (including Chiapas) and northwestern South America. *S. angulata*

7. Leaves epunctate beneath or nearly so; México. (8)

8. Stems stiffly erect, not much branched from the base; petioles mostly 3-6 mm long; Jalisco to Chiapas. *S. jorullensis*

8. Stems variously ascending to decumbent, much branched from the base; petioles mostly 6-20 mm long. (9)

9. Corollas 2-3 mm long; pedicels mostly 1-2 mm long. *S. verticillata*

9. Corollas 6-16 mm long; pedicels mostly 3-30 mm long. (10)

10. Corollas mostly 6-10 mm long; pedicels mostly 3-8 mm long; petioles mostly 3-9 mm long; coastal regions from Colima to Sinaloa, also in Cape Region of Baja California. *S. pusilla*

10. Corollas mostly 12-16 mm long; pedicels mostly 20-30 mm long; petioles mostly 9-18 mm long; inland regions of short tree forests, southern Sonora, northern Sinaloa and closely adjacent Chihuahua. *S. palmeri*

11. Stems and foliage densely white lanate. *S. tomentosa*

11. Stems and foliage otherwise. (12)

12. Annual taprooted herbs 5-25 cm high; stems ± uniformly pubescent with short glandular hairs 0.2 mm long or less; northeastern México and closely adjacent U.S.A. *S. schottii*

12. Perennial herbs mostly 20-100 cm high, frequently forming rhizomatous colonies; stems variously pubescent with longer hairs; widespread but not overlapping the range of *S. schottii*. (13)

13. Corollas mostly 11-15 mm long; localized semiaquatic inland species of southcentral and western México (Durango to Michoacán and México). *S. bartsioides*

13. Corollas mostly 2-8 mm long; widespread weedy species. (14)

14. Corollas 2.5-4.8 mm long, the tubes glabrous or nearly so; stems suffruticose; anther thecae widely separated by pedicels up to 0.5 mm long. *S. maritima*

14. Corollas 5-8 mm long, the tubes clearly pubescent; stems herbaceous; anther thecae close, merely separated by a globose connective. *S. durantifolia*

STEMODIA ANGULATA Oerst.

Stemodia angulata Oerst., Vidensk. Meddel. Dansk. Naturhist. Foren. Kjobenharn 1853:22. 1854. *Stemodiaca angulata* (Oerst.) Kuntze, Rev. Gen. Pl. 2:466. 1891. TYPE: COSTA RICA. Cartago: "prope Cartago", w/o date, Oersted 9472 (LECTOTYPE: C! [selected here]; Photolectotypes: F!, GH!; Isolectotype: K!). Oersted in his protologue also mentioned a Fendler collection which belongs to this taxon.

Stemodia ageratifolia C. Wright in Sauvile, Fl. Cubana 99. 1873. *Stemodia angulata* Oerst. subsp. *ageratifolia* (C. Wright) Minod, Bull. Soc. Bot. Geneve, ser. II 10:191. 1918. *Lindernia ageratifolia* (C. Wright) Pennell, Proc. Acad. Nat. Sci. Phila. 75:13. 1923. TYPE: CUBA. Pinar del Río: along margin of arroyos, Luiz Lazo and Arroyo Hondo, 1860-1864, Wright 2993 (HOLOTYPE: GH!; Isotypes: G!, GH!, MO!, NY, US!).

Stemodia jorullensis H.B.K. subsp. *reptans* Minod, Bull. Soc. Bot. Geneve, ser. II 10:190. 118. TYPE: NICARAGUA. Rivas: Ile de Omatepec, rues du village de Mayagulpa, 40 m, Oct 1869, P. Levy 154 (HOLOTYPE: G-BOIS!; Isotypes: C!, G!).

Annual or short lived perennial (?) herbs mostly 5-30 cm high. Stems erect at first, those at the lower nodes often procumbent, moderately crinkly pilose with multiseptate hairs 1-2 mm long. Midstem leaves mostly 1.0-2.5 cm long, 0.7-1.5 cm wide; petioles 5-10 mm long; blades ovate to subdeltoid, subpinnately nerved, grading into the petioles, sparsely pilose, glandular punctate beneath, the margins crenulodentate. Flowers axillary, arranged 1-3 at a node, the peduncles ebracteate, mostly 1-2 cm long, pubescent like the stems. Sepals mostly 4-5 mm long, pilose, one of these somewhat larger and broader. Corollas mostly 7-9 mm long, white or pinkish, the tubes glabrous or nearly so, the lobes 1-2 mm long, sparsely pubescent. Anther thecae ca. 0.6 mm long, glabrous, separated by a small globose connective. Capsule ovoid, 4-5 mm high, (3-)4 valvate, the apices recurved. Seeds ca. 0.5 mm long, stipitate, longitudinally sulcate with ca. 6-8 ribs.

DISTRIBUTION (Figures 1 and 2): México (Chiapas), Cuba, Central America and northwestern South America, 100-1000 m; flowering all seasons.

Pennell (1923), treated *Stemodia ageratifolia* as a good species, believing this to be endemic to Cuba. Minod (1918) treated this as a subspecies of *S. jorullensis*. For additional discussion see the latter.

REPRESENTATIVE SPECIMENS:

MEXICO. Chiapas: Mpio. Cacahoatán, 1-2 km S of Cacahoatán, 90 m, 24 Nov 1980, Breedlove 47760 (CAS).



Figure 1. American distribution of *Stemodia angulata*.



Figure 2. Central American distribution of *Stemodia angulata*.

WEST INDIES: CUBA. Pinar del Río: *Ekman 10638* (K).

CENTRAL AMERICA: BELIZE. pine ridge near Manatee Lagoon, 3 Jan 1903, *Peck 263* (GH).

COSTA RICA. Alajuela: 3 km E of Alajuela, 1000 m, 29 Dec 1974, *Wilbur 19048* (DUKE).

EL SALVADOR. Ahuachapán: vicinity of Ahuachapán, 800-1000 m, 9-27 Jan 1922, *Standley 20013* (GH).

GUATEMALA. Santa Ana: vicinity of Metepán, 370 m, 29 Jan-1 Feb 1947, *Standley s.n.* (F).

HONDURAS. Olancho: vicinity of Juticalpa, 380-480 m, 5-16 Mar 1949, *Standley 17490* (F).

NICARAGUA. Chontales: w/o date, *Tate 223* (K). Managua: Sierras de Managua, 800 m, 6-14 Jan 1941, *Grant 1002* (GH).

PANAMA. Darién: Río Morti, ca. 6 mi upstream from Morti Abajo, ca. 100 m, 14 Feb 1967, *Duke 10160* (DUKE, MO).

SOUTH AMERICA: COLOMBIA. Bolívar: Frasquillo, on Río Sinu, 20-100 m, 5-6 Mar 1918, *Pennell 4192* (C,K). El Valle: Cisneros, 300-500 m, 5 May 1939, *Killip 35615* (F, PH, US).

ECUADOR. Esmeraldas: Playa de Oro, Jul-Aug 1924, *Thomas L30* (K). Los Ríos: 14 km SE of Quevedo, 75 m, 22 Feb 1972, *MacBryde 1122* (MO).

PERU. Amazonas: Labanda, Huampami, Río Cenepa, Chacra, 600-700 ft, 3 Aug 1974, *Ancuash 712* (F, MO, TEX).

STEMODIA BARTSIOIDES Benth.

Stemodia bartsioides Benth., Bot. Reg. t. 1470. 1831. *Stemodiandra bartsioides* (Benth.) Kuntze, Rev. Gen. Pl. 2:466. 1891. TYPE: MEXICO.

Michoacán(?): "Plain of Popetongo", 1830, *Graham 273* (HOLOTYPE: K!; Photoholotype: NY!).

Stiffly erect perennial herbs 15-40 cm high. Stems essentially unbranched except at the very base, densely glandular pubescent, often arising from stout rhizomes. Midstem leaves mostly 2.0-3.5 cm long, 4-9 mm wide, sessile, lanceolate, widest near the middle, 2 or 3 at node, gradually reduced upwards, weakly subpinnately nerved, glandular pubescent, the surfaces also glandular punctate, the margins serrulate. Flowers mostly axillary along the upper half of the stems, arranged 2-4 at a node, the pedicels 1-8 mm long, glandular pubescent. Sepals 5-6 mm long, glandular pubescent, essentially alike, below these 1 or 2 bracts about as long or somewhat longer than the sepals. Corollas mostly 11-15 mm long, light to violet blue, sparsely pubescent, the lobes 3-6 mm long. Anther thecae purple, ca. 0.6 mm long, on minute stalks separated by a swollen connective. Capsules 3-4 mm long, broadly ovoid, 4 valvate, the

apices erect. Seeds ca. 0.4 mm long, stipitate, moderately minutely warty throughout.

DISTRIBUTION (Figure 3). Mostly semiaquatic or aquatic habitats of the Central Plateau region of México from Durango and Zacatecas to Michoacán and México, 2000-2500 m; flowering August-September.

Minod (1918) knew this species by relatively few collections. He cited a specimen from Colombia (near Bogotá) which we believe to be in error.

REPRESENTATIVE SPECIMENS:

MEXICO. Aguascalientes: 15 km E of Aguascalientes, 2100 m, 29 Aug 1960, Rzedowski 14182 (MEXU). Durango: ca. 13 mi NE of Durango along route 31, 25 Jul 1958, Correll 20158 (LL). Guanajuato: 1 mi NW of Salamanca, 16 Aug 1957, Waterfall 13899 (TEX,US). Hidalgo: Mpio. de Huichapan, Atlán, ca. 2000 m, 24 Jun 1980, Hernández 4548 (CAS,MEXU). Jalisco: just E of Aguascalientes State Line, road from Ojuelos, ca. 13 mi W of Paso de la Troje, 2000 m, 13 Aug 1958, McVaugh 16995 (DUKE,G,LL,MEXU,MICH,TEX,US). México: w/o locality, 1839, Hartweg 196 (G,GH). Michoacán: 5 mi W of Morelia, 22 Aug 1961, Powell 824 (F,MICH,TEX). Querétaro: Cadereyta, 27 Jul 1952, Kelly 715 (UC). Zacatecas: 9 mi W of Sombrerete, 2400-2500 m, 26 Sep 1948, Gentry 8486 (GH,MEXU,MICH,UC,US).

STEMODIA CHIAPENSIS B. Turner

Stemodia chiapensis B. Turner, sp. nov. TYPE: MEXICO. Chiapas: Mpio. Arriaga, "Steep pacific canyon with Tropical Deciduous Forest and crest of ridge with *Pinus* and *Quercus* at La Mina Microwave Station", 980 m, 13 Nov 1983, D.E. Breedlove & F. Almeda 60155 (HOLOTYPE: TEX!).

Stemodia tenuifolia Minod similis sed foliis longioribus (plerumque 3.0-4.5 cm longis vs. 1.5-2.5 cm) petiolis longioribus (10-20 mm longis vs. 2-6 mm), corollis longioribus (10-12 mm longis vs. ca. 8 mm), et vestimento caulino trichomatibus brevioribus (ca. 0.3 mm altis vs. 1-2 mm) plus incurvatis differt.

Erect suffruticose perennial herbs to 30 cm high. Stems terete, evenly pubescent with an incurved puberulous vestiture ca. 0.3 mm high or less, glabrescent with age. Midstem leaves drying green, mostly 3.0-4.5 cm long, 1.5-2.5 cm wide; petioles 10-20 mm long, grading into the blades; blades ovate, subpinnately nerved, sparsely pubescent like the stems, especially along the veins, the margins crenulodentate. Flowers axillary, 2-4 to a node, arranged

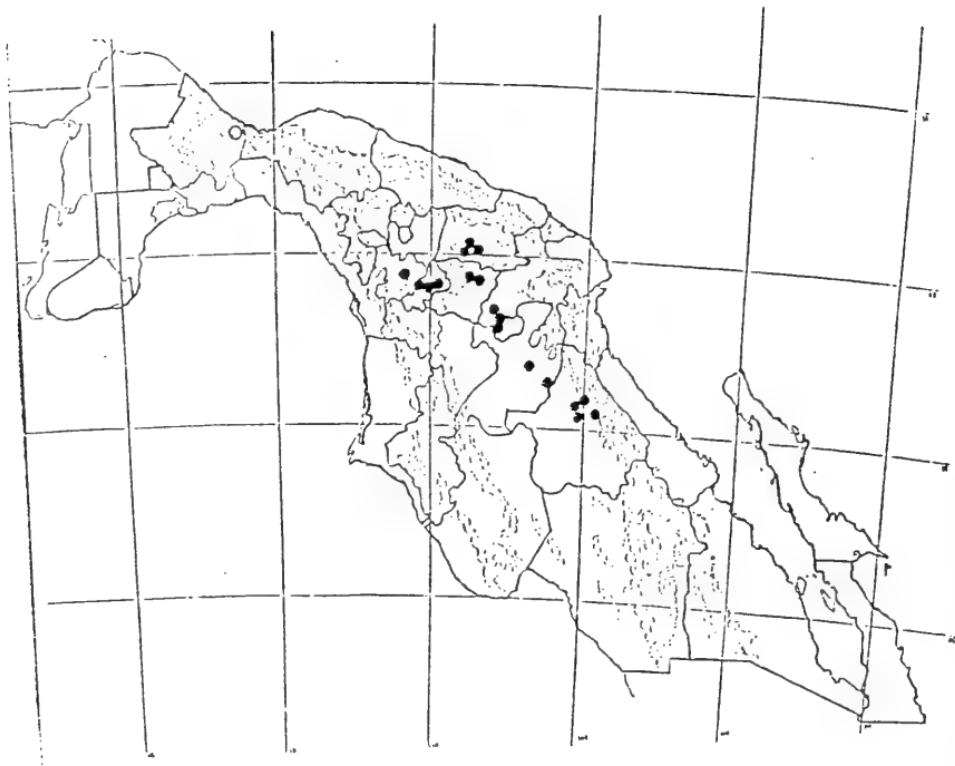


Figure 3. Distribution of *Stemodia bartsioides* (closed circles) and *S. chiapensis* (open circle).

in terminal foreshortened stems, the pedicels mostly 2-4 mm long, puberulent. Sepals 5, ± all alike, 5-6 mm long, linear-lanceolate, strigose, ebracteate. Corollas mostly 10-12 mm long, drying yellow but described as "white with yellow" or "with pale yellow throat", the lobes 1.5-3.0 mm long, the tube cylindrical, pubescent throughout externally, long pilose within near the orifice, the latter hairs with spatulate apices. Anther thecae ca. 0.5 mm long, separated by a well developed ovoid connective. Capsule ovoid, 4.5-5.5 mm high, 4 valvate, the valves erect. Seeds ca. 0.8 mm long, 6-8 sulcate, stipitate.

DISTRIBUTION (Figure 3). Known only from the type locality, Mpio. Arriaga, Chiapas, pine-oak forests, 900-1000 m; flowering November-December.

Stemodia chiapensis is closely related to *S. tenuifolia* but is readily distinguished from the latter by its mostly longer leaves (3.0-4.5 cm long vs. 1.5-2.5 cm) with longer petioles (10-20 mm long vs. 2-6 mm), longer corollas (10-12 mm long vs. ca. 8 mm), and a shorter, more incurved vestiture on the stems. In habit, the species superficially resembles *Capraria saxifragaeifolia* Cham. & Schlecht., but is easily distinguished from the latter by its opposite leaves.

ADDITIONAL SPECIMEN EXAMINED: MEXICO. Chiapas: Mpio. Arriaga, La Mina Microwave Station, 915 m, 21 Dec 1981, Breedlove 56329 (TEX).

STEMODIA DURANTIFOLIA (L.) Swartz

Stemodia durantifolia (L.) Swartz, *Obs. Bot.* 240. 1791.

This is an extremely weedy, widespread species, as noted in more detail below. We recognize two regionally differentiated varieties, as follows:

1. Corollas mostly 9-11 mm long; stems with predominantly crinkly hairs, with intermixed glandular hairs; Chile. var. *chilensis*
1. Corollas mostly 5-8 mm long; stems variously pubescent, but mostly glandular pubescent; widespread. var. *duranatifolia*

STEMODIA DURANTIFOLIA (L.) Swartz var. *DURANTIFOLIA*

Stemodia durantifolia (L.) Swartz, *Obs. Bot.* 240. 1791. BASIONYM: *Capraria durantifolia* L., *Syst. Nat.*, ed. 10. 1116. 1759 (May-Jun). *Stemodiaca durantifolia* (L.) Morong, *Pl. Coll. Paraguay* 183. 1880-1893. According to D'Arcy (1979), with whom we agree, this name is based upon *Lysimachia coerulea galericulata* ... Sloane, *Cat. Pl. Jamaic.* 66. 1696 (LECTOTYPE: BM! [selected here]).

Capraria oppositifolia L., *Fl. Jamaic.* 380. 1759. *Stemodia erecta* (P. Br.) Minod, *Bull. Soc. Bot. Geneve*, ser. II, 10:212. 1918. Both based on the same type. TYPE: JAMAICA. According to D'Arcy, with whom we agree, this name is based, in part, upon *Phaelaea erecta; foliis sessilibus* ... R. Br. (LECTOTYPE: BM! [selected here]). Browne also cited *Lysimachia coerulea galericuta* ... Sloane, which has been selected as the lectotype for *Capraria durantifolia* L., as noted above.

Conobea verticillaris Spreng., *Novi Prov. Hort. Acad. Hal.* 13. 1818. *Stemodia verticillaris* (Spreng.) Link, *Enum. Pl. Hort. Berol.* 2:144. 1822. TYPE: BRAZIL: from material cultivated in the Berlin Botanical Garden (HOLOTYPE: B, destroyed; Photoholotypes: G!, GH!, MO!; Isotype: LE!).

Scrophularia subhastata J. Velloso, *Fl. Flumin.* 6: t. 88, 264. 1827. *Stemodia subhastata* (J. Velloso) Benth. in DC., *Prodr.* 10:381. 1846. *Stemodia subhastata* (J. Velloso) Kuntze, *Rev. Gen. Pl.* 2:466. 1891. TYPE: BRAZIL: "prope Rio de Janeiro", 1782-1789, *Velloso s.n.?* (LECTOTYPE: K! [designated here]). The lectotype is w/o collector but is said to be from "Rio Jan" in what is thought to be the script of Velloso.

Stemodia ehrenbergiana Schlecht., *Bot. Zeit.* 1:169. 1843. TYPE: MEXICO. grown from seeds in 1842 provided by Ehrenberg, probably from Veracruz (HOLOTYPE: HAL, not located). The taxon was originally compared with *S. durantifolia*, otherwise it is essentially without description.

Stemodia berteroana Benth. in DC., *Prodr.* 10:384. 1846. *Stemodiaca berteroana* (Benth.) Kuntze, *Rev. Gen. Pl.* 2:466. 1891. TYPE: DOMINICAN REPUBLIC [Hispaniola]. *Bertero s.n.* (HOLOTYPE: K, not located; Isotype: M!; Photoisotypes: F!, GH!, MO!).

Stemodia durantifolia (L.) Swartz var. *angustifolia* Griseb., *Fl. Br. West Ind.* 429. 1861. TYPE: JAMAICA. w/o locality, 1858, March 826 (LECTOTYPE: K! [selected here]). Grisebach describes this taxon as being densely pubescent and devoid of eglandular hairs, the leaves linear-lanceolate and tapering nearly to the base, such as found in the lectotype and which bears the handwritten notation, Beta *angustifolia*. On the same sheet is mounted the typical form of the species.

Stemodia arizonica Pennell, *Not. Nat. Acad. Nat. Sci. Phil.* 43:3. 1940. TYPE: UNITED STATES. Arizona: Pima Co., by streams of the Santa Catalina Mts., 2000-3000 ft, 11 Apr 1881, C.G. Pringle *s.n.* (HOLOTYPE: PH!; Isotypes: F!, G-DC!, GH!, MICH!, MO!, US!, WIS!).

Stemodia bissei Tsvelev, Bot. Zh. (Leningrad) 72:1662. 1987. TYPE: CUBA. Prov. Pinar del Río: Matahambre, Halas Aguas, Monte al Fote de la desembocadura del Río Malas Aguas, 28 Mar 1982, J. Bisce et al. s.n. (HOLOTYPE: HAJB).

Erect mostly perennial viscid herbs 20-100 cm high. Stems usually stiffly erect or ascending, variously pubescent with either pilose eglandular or glandular hairs 1-2 mm long, or both, below these a more uniform vestiture of short glandular hairs 1 mm long or less, sometimes only short glandular hairs are found. Midstem leaves 2 or 3 to a node, sessile, mostly 2-7 cm long, 0.5-2.0 cm wide, usually clasping at the base, pinnately nerved, glandular pubescent on both surfaces, the margins serrate. Flowers 2-4 at a node, axillary, usually forming pronounced terminal bracteate interrupted spikes, the pedicels usually less than 1 mm long, but occasionally up to 8 mm long. Sepals 3-5 mm long, ± alike, variously pubescent, subtended by 1 or 2 basal bracts as long as or somewhat longer than the sepals. Corollas blue to purplish, minutely pubescent, mostly 5-8 mm long, the lobes 1-2 mm long. Anther thecae ca. 0.5 mm long, separated by a globose connective. Capsule ovoid, 4-5 mm long, 4 valvate, their apices merely somewhat dorsally arcuate. Seeds ellipsoid, ca. 0.3 mm long, weakly 5 ribbed at best, pedicellate, bearing minute well separated warts in longitudinal lines.

DISTRIBUTION (Figures 4, 5, and 6): A weedy species found throughout much of the tropical and subtropical regions of the New World, extending into the drier more temperate regions of western North and South America from California, U.S.A., to Brazil and Perú; recent introductions also occur elsewhere; flowering all seasons.

Minod (1918) treated *Stemodia durantifolia* within his concept of *S. erecta*, not appreciating or being aware of the priority of the former name. D'Arcy (1979) has treated in some detail most of the nomenclature accounted for in the above. He did not, however, distinguish var. *chilensis*.

Stemodia durantifolia is an exceedingly variable species and its separation into the two varieties recognized here is largely based upon the geographical isolation of Chilean populations having larger corollas and more often verticillate leaves than occur elsewhere. Because of the 1000 or more sheets examined, we have abbreviated the cited collections that follow.

The recently described *Stemodia bissei* appears to be a form of the present with somewhat longer pedicels. Pedicel length is quite variable in *S. durantifolia*; although it mostly varies between 1-8 mm, occasionally plants may have pedicels up to 20 mm long (e.g., México, Baja California, Turner 3643, TEX).

REPRESENTATIVE SPECIMENS (from among 1500 or more):

MEXICO. Baja California Sur: Gentry 4944 (ARIZ,K). Campeche: Lundell 1372 (DS,F,MICH,MO,US). Chiapas: Cowan 5017 (MEXU,TEX). Chihuahua: Palmer 74 (GH,K,US). Colima: Palmer 112 (GH,US). Durango:

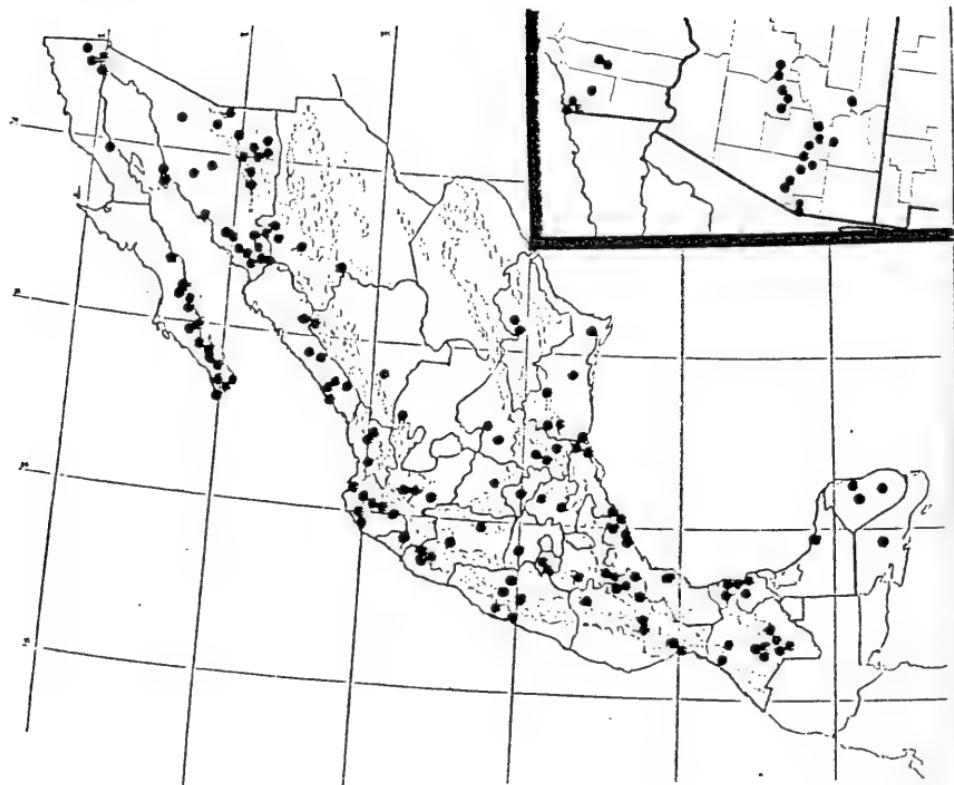


Figure 4. Distribution of *Stemodia durantifolia* in U.S.A. (inset) and México.

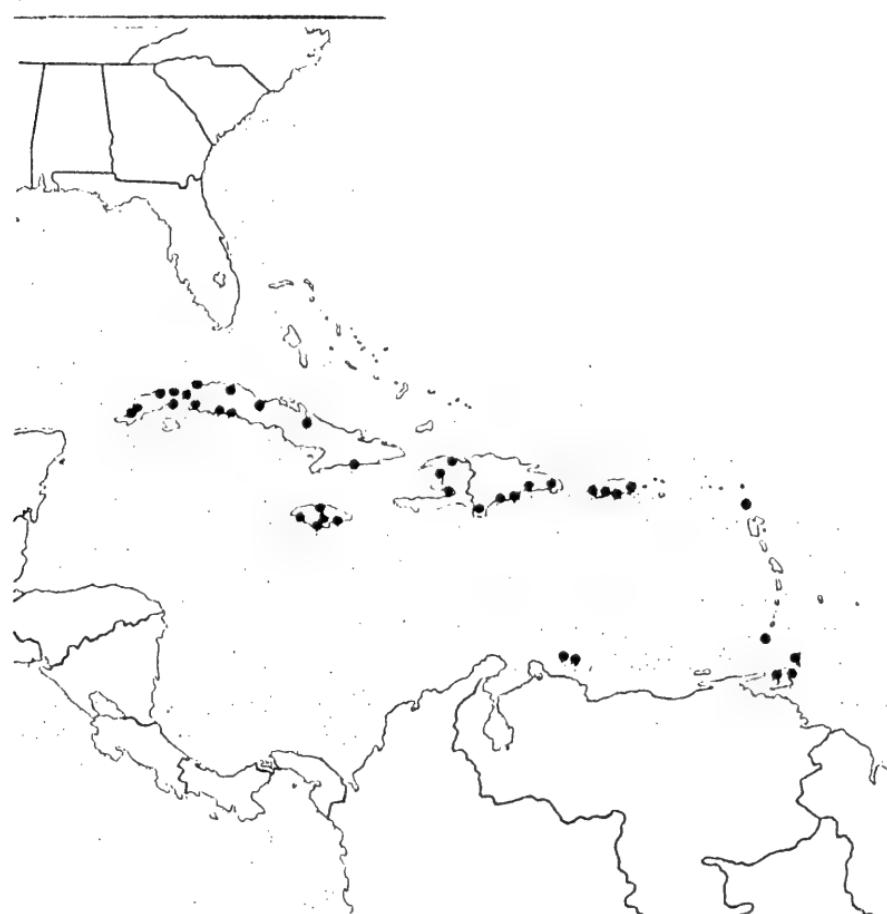


Figure 5. Distribution of *Stemodia durantifolia* in West Indies.



Figure 6. Distribution of *Stemodia durantifolia* in Central America.

Herrera 572 (TEX). Guanajuato: *Kishler* 911 (MEXU). Guerrero: *Hinton* 5437 (GH,K). Hidalgo: *Rzedowski* 25427 (ENCB). Jalisco: *Ayala* 722 (MEXU,TEX). México: *Hinton* 5296 (GH,US). Michoacán: *Cowan* 4917 (MEXU,TEX). Morelos: *Pringle* 9510 (GH,US). Nayarit: *Cowan* 4795 (TEX). Nuevo León: *Smith* M45 (TEX). Oaxaca: *Pringle* 6035 (GH,K). Puebla: *Rzedowski* 28951 (ENCB,TEX). Querétaro: *Rose* 9755 (US). Quintana Roo: *Olmstead* 720 (MEXU). San Luis Potosí: *Schaffner* 714 (GH,K). Sinaloa: *Ortega* 647 (K). Sonora: *Cowan* 5559 (MEXU,TEX). Tabasco: *Ventura* 21048 (ENCB,TEX). Tamaulipas: *Johnston* 5026A (TEX). Yucatán: *Steere* 2009 (MICH). Zacatecas: *McVaugh* 17655 (MICH).

EL SALVADOR. Santa Ana: *Standley* 3122 (F). San Miguel: *Standley* 21076 (F). San Vicente: *Standley* 3376 (F). Sonsonate: *Standley* 22109 (F).

BELIZE. Distr. Belize: *Croat* 23327A (MO). El Cayo: *Gentle* 9660 (DUKE,F,MEXU,US).

GUATEMALA. Chiquimula: *Steyermark* 30143 (F). Izabal: *Blake* 7287 (US). Jutiapa: *Standley* 76001 (F). Petén: *Contreras* 2919 (DUKE,LL,TEX). Progreso: *Standley* 69005 (F). Retalhuleu: *Harmon* s.n. (MO). Zacapa: *Standley* 72045 (F).

HONDURAS. Comayagua: *Standley* 5259 (F). Copán: *Molina* 24692 (F). Cortez: *Standley* 7192 (F). Morazán: *Molina* 25949 (F). Yoro: *Standley* 53893 (F).

NICARAGUA. Boaca: *Seymour* 6076 (F). Chontales: *Standley* 9243 (F). Estelí: *Standley* 20193 (F). Managua: *Grant* 1108 (GH!). Matagalpa: *Williams* 23758 (F). Zelaya: *Molina* 2289 (F).

PANAMA Canal Zone: *McDaniel* 12665 (DUKE). Los Santos: *Butch* 1555 (MO). Panamá: *McDaniel* 10322 (MO).

COSTA RICA. Guanacaste: *Liesner* 4421 (MO). Puntarenas: *Quiros* 15 (F). San José: *Jiménez* 1295 (US).

WEST INDIES: ANTIGUA. *Box* 1018 (F).

BONAIRE. *Arnoldo* 3787 (AA).

CUBA. *Curtis* 529 (BM,G,PHIL,US).

CURACAO. *Arnoldo* 1626 (F).

DOMINICAN REPUBLIC. *Allard* 15697 (US).

GRENADE. *Broadway* 1761 (F).

HAITI. *Leonard* 7727 (UC,US).

JAMAICA. *Proctor* 34865 (BM).

PUERTO RICO: *Urban* 1057 (G,GH,LIL,US).

TRINIDAD: *Barnard* 274 (MO).

UNITED STATES. Arizona: Gila Co.: *Niles* 368 (ARIZ); Maricopa Co.: *Pennell* 24970 (ARIZ,F,PH,UC,US); Navajo Co.: *Girard* s.n. (MICH); Pima Co.: *Thurber* 320 (ARIZ,MO,US); Pinal Co.: *Crutchfield* 261 (LL); Santa Cruz Co.: *Kaiser* 1291 (ARIZ); Yavapai Co.: *Foster* 327 (DS,GH,PH,US).

California: Riverside Co.: *Parish 4135* (DS,GH,MO,PH,UC,US); San Diego Co.: *Palmer 284* (F,G,MO,PH).

STEMODIA FRUTICOSA Lundell

Stemodia fruticosa Lundell, Contr. Univ. Michigan Herb. 4:27. 1940. TYPE: BELIZE. El Cayo District: Vaca, 24 Feb 1938, *Percy H. Gentle* 2252 (HOLOTYPE: MICH!; Isotype: LL!).

Stemodia glabra Oerst. in Benth. & Oerst., Kjoebenh. Vidensk. Meddel 21. 1853. *Stemodiaca glabra* (Oerst.) Kuntze, Rev. Gen. Pl. 2:166. 1891. Not *Stemodia glabra* Spreng. 1825. TYPE: NICARAGUA. "Prov. Segovia", 1852, *Oersted* 9474 (HOLOTYPE: C!; Photoholotypes: F!,GH!,MO!; Isotypes: C!,K!).

Stemodia hondurensis Standl. & Williams, Ceiba 3:60. 1952. TYPE: HONDURAS. Olancho: vicinity of Juticalpa, 380-480 m, 5-16 Mar 1949, *Paul C. Standley* 17812 (HOLOTYPE: US!; Photoholotypes: F!,GH!,LL!,UC!,US!; Isotype F!). The holotype was originally deposited in the "Herb. Esc. Agr. Panam." but subsequently transferred to US.

Suffruticose perennial herbs, shrublets, or shrubs (0.3-)1.0-2.0 m high. Stems brownish, brittle, densely short puberulent or sparsely pilose at first but glabrescent and coky white with age. Midstem leaves mostly 5-8 cm long, 2.0-3.5 cm wide, drying black; petioles 0.3-1.0 cm long; blades ovate-lanceolate, pinnately nerved, moderately hirsute to glabrate, the surfaces epunctate or nearly so, the margins serrate. Flowers axillary, arranged 2-4 at a node, the peduncles ebracteate, 5-20 mm long, pubescent like the stems. Sepals ± alike, mostly 6-9 mm long, puberulent with short incurved eglandular hairs, or occasionally both glandular pubescent and puberulent. Corollas 14-18 mm long, white to lilac, the tube sparsely pubescent, the lobes 2-5 mm long. Anther thecae glabrous, ca. 0.7 mm long, separated by a globose connective, ca. 0.5 mm across. Capsules broadly ovate, 4-6 mm high, 4 valvate, the apices not erect. Mature seeds not available.

DISTRIBUTION (Figure 7): Belize, Honduras and El Salvador, dry rocky forests, 500-1600 m; flowering January-April.

REPRESENTATIVE SPECIMENS:

EL SALVADOR. Morazán: south side of Montes de Cacaquatique, ca. 1500 m, 7 Jan 1942, *Tucker 740* (F,G-DEL,LL,MICH,UC). Santa Ana: Hacienda San Miguel near Metapán, 600-1380 m, 22 Feb 1946, *Carlson 804* (F).

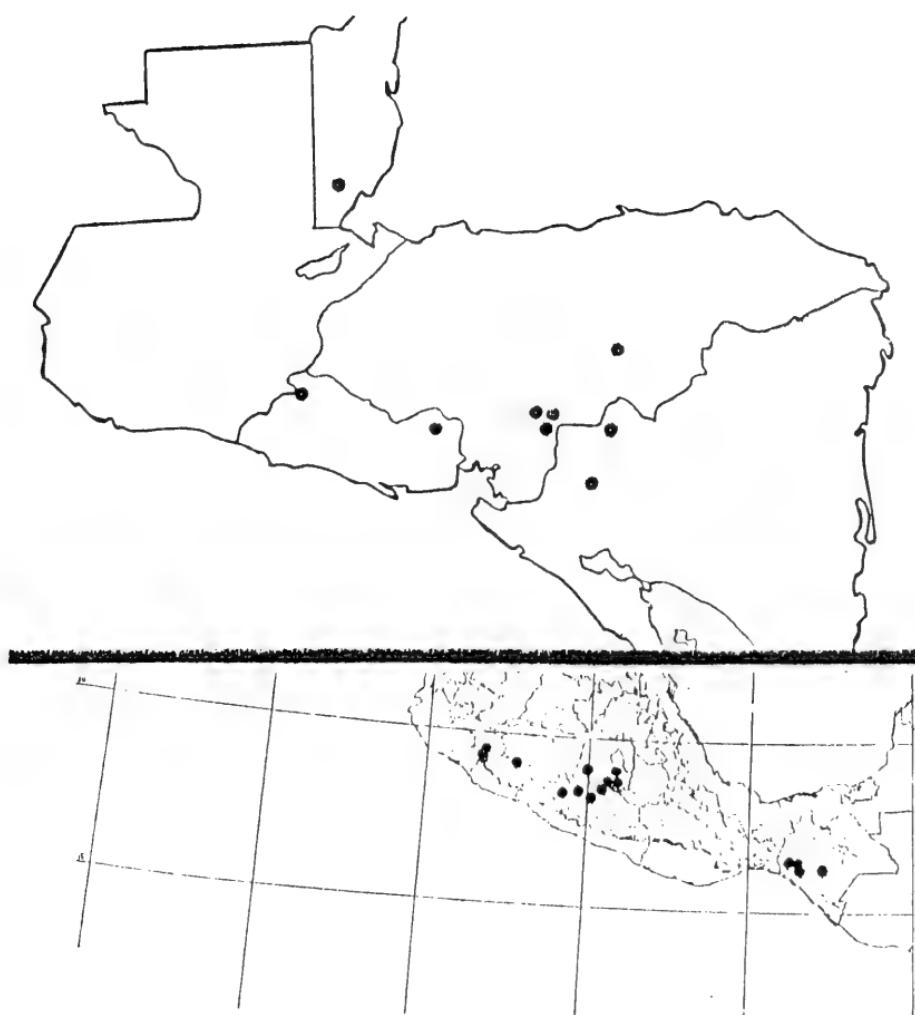


Figure 7. Distribution of *Stemodia fruticosa* (upper figure) and *S. jorullensis* (lower figure).

HONDURAS. El Paraiso: 12 km NE of Yuscaran, 900 m, 30 Jun 1961, *Molina 10040* (F,GH,US). Olancho: vicinity of Juticalpa, 380-480 m, 5-16 Mar 1949, *Standley 18132* (A,F,US).

NICARAGUA. Matagalpa: along Río Las Canas, 10-15 km NE of Matagalpa, 600-700 m, 16 Jan 1963, *Williams 24021* (F,MEXU).

STEMODIA JORULLENSIS H.B.K.

Stemodia jorullensis H.B.K., Nov. Gen. & Sp. 2:358. 1817. *Stemodiaca jorullensis* (H.B.K.) Kuntze, Rev. Gen. Pl. 2:166. 1891. TYPE: MEXICO. Michoacán: Volcán Jorullo, "490 hex", 19 Sep 1803, *Humboldt & Bonpland s.n.* (HOLOTYPE: P; Photoholotypes: F!, GH!, MO!).

Stemodia micrantha Brandegee, Univ. Calif. Publ. Bot. 6:63. 1914. Not *Stemodia micrantha* Benth. TYPE: MEXICO. Chiapas: Cerro de Tonala, Sep 1913, C.A. Purpus 6806 (HOLOTYPE: UC!; Isotypes: F!, GH!, MO!, US!).

Stemodia neglecta Minod, Bull. Soc. Bot. Geneve, ser. II, 10:195. 1918: TYPE: MEXICO. w/o locality, w/o date, *Sessé & Moçiño s.n.* (HOLOTYPE: G!; Photoholotypes: F!, GH!, MO!). The type is from "Nueva Espana" where Minod thought it to have been collected by Pavon. But the latter collector was never in México, although the sheet concerned was once part of Pavon's herbarium. McVaugh correctly notes, by annotation on the type sheet, that a descriptive account that accompanies the type is written in the hand of Sessé. Thus the Pavon notation is probably an error. Regardless, the plant concerned, with its broad, shortly petiolate leaves and hirsute vestiture, closely matches what is here recognized as *S. jorullensis*.

Annual herbs mostly 20-30 cm high, stems stiffly erect, simple, not branched at the base. Stems pilose with multiseptate stiff hairs 1-2 mm long, beneath this a vestiture of shorter glandular trichomes. Midstem leaves mostly 1-2 cm long, 1.0-1.5 cm wide; petioles mostly 3-6 mm long; blades broadly ovate to deltoid, pubescent like the stems, subpinnately veined, epunctate or nearly so, the margins irregularly crenulodentate. Flowers axillary, arranged 2-3 at a node, the peduncles ebracteate, mostly 5-10 mm long, pubescent like the stems. Sepals 5, mostly 4-6 mm long, pilose. Corollas mostly 6-9 mm long, violet, the tubes sparsely pubescent, the lobes 2-3 mm long, glabrous or nearly so. Anther thecae ca. 0.5 mm long, glabrous, separated by an oval connective. Capsule narrowly ovoid, 5-6 mm high, 2 valvate, the apices somewhat recurved. Seeds ca. 0.5 mm long, ellipsoid, stipitate, longitudinally sulcate with 6-8 ribs.

DISTRIBUTION (Figure 7): known only from southern México in montane wooded areas, mostly 1000-2000 m; flowering September-November.

This taxon has long been confused with *Stemodia angulata* but is readily distinguished from the latter in having stems with glandular pubescence, and epunctate leaves with shorter petioles. Its closest relationship appears to be with *S. pusilla* Benth., differing from the latter in having more stiffly erect primary stems with little branching from the base; in addition the blades are more commonly deltoid with shorter petioles.

Immature specimens of *Stemodia jorullensis* from Chiapas with somewhat smaller corollas were called *S. micrantha* by Brandegee.

Minod's broad treatment of *Stemodia jorullensis* included three subspecies: 1) subsp. *jorullensis* (his subsp. *genuina*) of which he cited two specimens, the type and Seler 4981 from México, San Andres Tuxtla, Veracruz; the latter specimen, however, appears to be *S. angulata*; 2) subsp. *reptans*, the type from Costa Rica; this appears to be *S. angulata*; 3) subsp. *ageratifolia*, the type from Cuba; this also appears to be *S. angulata*.

REPRESENTATIVE SPECIMENS:

MEXICO. Chiapas: Mpio. Cintalapa, Cerro Baul to Colonia Figaroa, 100 m, 7 Jan 1973, Breedlove 31272 (DS). Colima: Tuxpan, 11 Apr 1910, Orcutt 4704 (F). Guerrero: Distr. Adama, Temisco, Barranca del Consuelo, 520 m, 15 Nov 1937, Mexia 8816 (B,F,G,GH,MO,PH,UC). Jalisco: Tonalita, 5 Nov 1910, Orcutt 6481 (TEX).

STEMODIA LANATA Sessé & Moçiño ex Benth.

Stemodia lanata Sessé & Moçiño ex Benth. in DC., *Prodr.* 10:363. 1846.

TYPE: MEXICO. Veracruz: beach sand near Tecolutla, 1837, Schiede & Deppe s.n. (LECTOTYPE: K! [selected here]; Isolectotype: LE!).

Erinus tomentosus Miller, *Gard. Dict.*, ed. 1, no. 2, 1731. *Stemodiaca tomentosa* (Miller) Kuntze, *Rev. Gen. Pl.* 2:466. 1891. *Stemodia tomentosus* (Miller) Greenm. & Thompson, *Ann. Missouri Bot. Gard.* 1:409. 1914. TYPE: MEXICO. Veracruz, 1730, *Houston* s.n. (HOLOTYPE: BM!; Photoholotype: UC!). Not *Stemodia tomentosa* (Roxb.) G. Don 1838.

Herpestis tomentosa Schlecht. & Cham., *Linnaea* 5:106. 1830. TYPE: MEXICO. Veracruz: sandy areas about Veracruz, 1837, Schiede & Deppe 175 (HOLOTYPE: HAL; Isotypes: BM!, LE!).



Figure 8. Distribution of *Stemodia macrantha* (open circles), *S. maritima* (closed circles), and *S. palmeri* (open triangles).

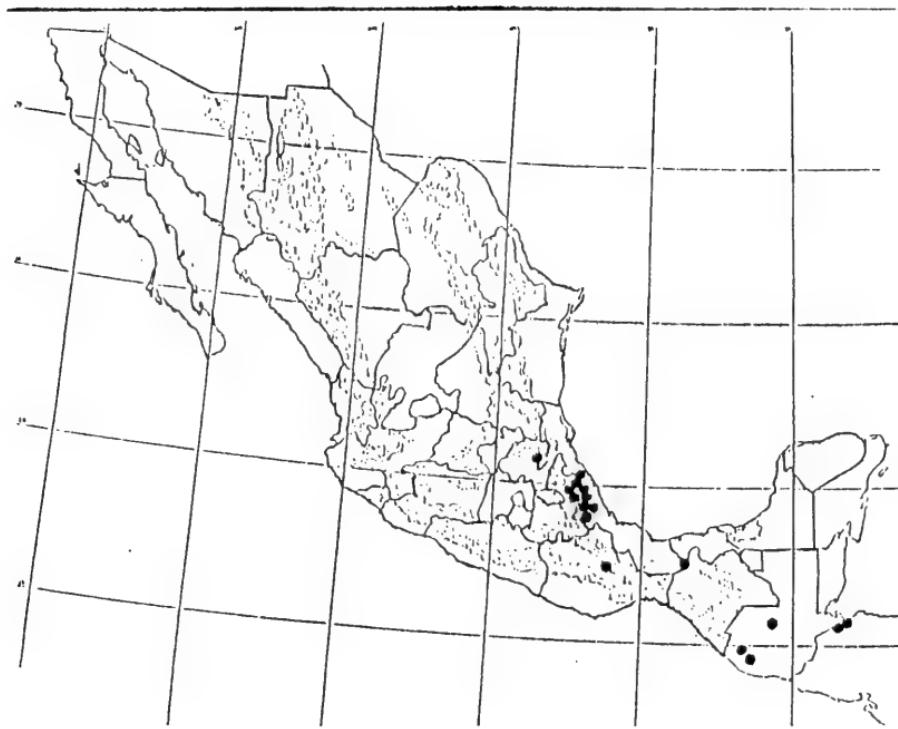


Figure 9. Distribution of *Stemodia peduncularis*.

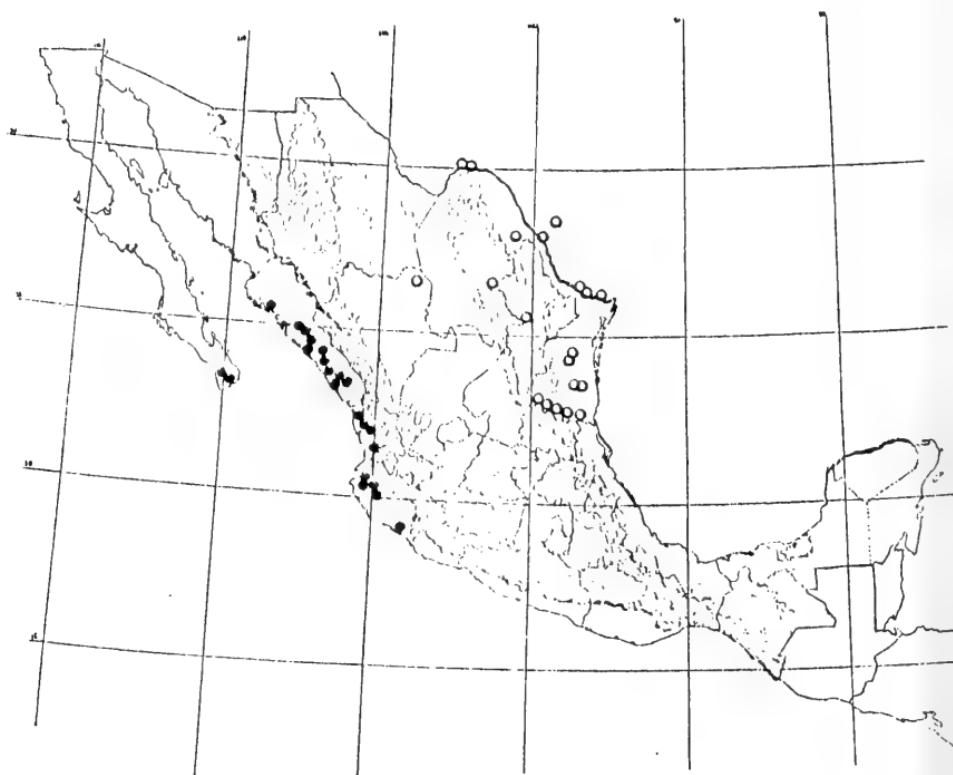


Figure 10. Distribution of *Stemodia pusilla* (closed circles) and *S. schottii* (open circles).

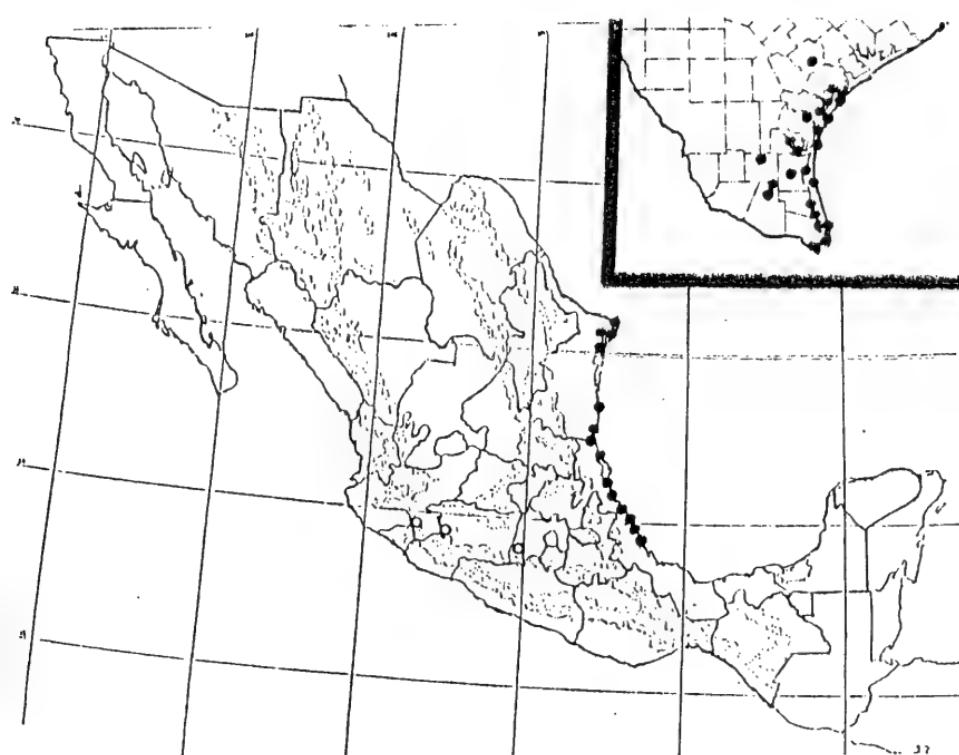


Figure 11. Distribution of *Stemodia tenuifolia* (open circles) and *S. lanata* (closed circles); inset, distribution in Texas.

DISTRIBUTION (Figure 11): Mostly sandy seashores or alluvial sands along coastal rivers, central and northeastern coastal México and adjacent U.S.A. (southernmost Texas), 0-50 m; flowering all seasons.

Prostrate, white tomentose or lanate perennials 5-10 cm high. Stems tomentose, rooting at the nodes. Midstem leaves mostly 1.0-2.5 cm long, 0.5-1.0 cm wide, pinnately nerved, elliptic lanceolate to obovate, sessile, white tomentose, the margins denticulate. Flowers axillary, relatively few, arranged 1 or 2 at a node, sessile or nearly so. Sepals ± alike, 4-5 mm long, white tomentose, bounded by 1 or 2 short basal bracts. Corollas 6-7 mm long, the tube minutely puberulent, the lobes 1-2 mm long, not especially zygomorphic. Anther thecae ca. 0.6 mm long, white or beige, separated by a small globose connective. Capsules ovoid, 2-3 mm long, 4 valvate, the apices mostly erect. Seeds, ca. 0.3 mm long, weakly ellipsoid, stipitate if at all, ornamented with a mesh of low ridges arranged in 5-7 sided figures, not at all warty.

Because of its tomentose vestiture this is the most easily recognized of all *Stemodia* species. It is seemingly closely related to the *S. durantifolia* complex (by leaves and anther shape) but is readily separated by seed ornamentation.

REPRESENTATIVE SPECIMENS:

UNITED STATES. Texas: Aransas Co.: Aransas National Wildlife Refuge, ca. 3 m, 8 May 1959, *Traverse* 1314 (F,GH,LL,MO); Brooks Co.: 23 mi E of Hebbronville, 18 Nov 1962, *Solis* 67 (LL,TEX); Cameron Co.: Boca Chica, Clarke Island, 7 Jun 1943, *Clover* 1254 (ARIZ,MICH,MO); Goliad Co.: Goliad, Jun 1927, *Williams* 177 (PH,TEX,US); Hidalgo Co.: ca. 8 mi N of San Manuel, 9 Apr 1944, *Lundell* 12797 (LL,MEXU,UC); Kenedy Co.: beach ridge along Laguna Madre, 20 Apr 1954, *Johnston* 54599 (TEX); Kleberg Co.: near coast, King Ranch, 3 Jul 1953, *Johnston* 54445 (TEX); Nueces Co.: Mustang Island, 29 Jul 1967, *Gillespie* 300 (TEX); San Patricio Co.: 8 mi SW of Aransas Pass, 22 Apr 1947, *Whitehouse* 18207 (ARIZ,MICH,TEX); Willacy Co.: Sandy flats near Port Mansfield, 27 Jun 1950, *Webster* 3077 (MICH,US).

MEXICO. Tamaulipas: Sand dunes, 1 mi N of Cd. Madero, 1 Mar 1961, *King* 3991 (F,MICH,TEX,US). Veracruz: along shore near Veracruz, 24 Jan 1906, *Greenman* 106 (F,GH).

STEMODIA MACRANTHA B. Robinson

Stemodia macrantha B. Robinson, Proc. Amer. Acad. Arts 34:27. 1907

TYPE: MEXICO. Michoacán: near the foot of the falls of Tzararacua below Uruapan, 28 Jan 1907, C.G. Pringle 10356 (HOLOTYPE: GH).

Isotypes: ARIZ!, C!, F!, G-BOIS!, G-DC!, G-DEL!, K!, LE!, MICH!, M!, MO!, PH!, UC!, US!).

Trevirania parviflora Hook. & Arn., *Bot. Beechey Voy.* 302. 1839.
Dicyrla parviflora (Hook. & Arn.) Seemann, *Bot. Voy. Herald* 326.
1856. *Anetanthus parviflorus* (Hook. & Arn.) Benth. & Hook. f.,
Gen. Pl. 2:1025. 1876. Not *Stemodia parviflora* W.T. Aiton, 1789.
TYPE: MEXICO. Nayarit(?): w/o specific locality, *Beechey s.n.*
(HOLOTYPE: K!).

Suffruticose perennial herbs 0.5-1.5 m high. Stems sparsely to moderately pilose with multiseptate hairs 1-2 mm long, beneath these a finer array of short glandular trichomes. Midstem leaves mostly 3-7 cm long, 2-3 cm wide; petioles 1.0-1.5 cm long; blades broadly ovate, sparsely pilose to both pilose and glandular pilose, especially along the veins, the undersurfaces glandular punctate. Flowers axillary, mostly arranged 2-4 at a node, the peduncles ebracteate, mostly 2-4 cm long, pubescent like the stems. Sepals mostly 7-10 mm long, pilose with both nonglandular and glandular hairs. Corollas mostly 14-20 mm long, reportedly white, yellow, or purple (yellow tube with white lobes, according to Anderson 5986, TEX), the tube sparsely pubescent, the lobes 3-5 mm long. Anther thecae ca. 0.5 mm long, glabrous, separated by an ovoid connective ca. 0.4 mm across. Capsules ovoid, 5-7 mm high, (3-)4 valvate, somewhat recurved apically. Seeds ca. 0.8 mm long, ellipsoid, stipitate, 6-8 sulcate, finely muricate along the ribs.

DISTRIBUTION (Figure 8): Mainly Pacific Coastal Region from Nayarit, México to Honduras, mostly pine-oak forests, 1000-1800 m; flowering November-March.

This taxon is closely related to *Stemodia peduncularis* of eastern México; it is readily distinguished from the latter by its spreading pilose vestiture (the hairs mostly 1-2 mm long) beneath which usually occurs a much shorter layer of glandular tipped hairs (mostly 0.5 mm long or less), rarely not. In addition, the leaf blades are only sparsely or weakly glandular punctate beneath, the latter usually pale yellowish in color (vs. abundantly endowed with amber to brown punctations in *S. peduncularis*).

We include here collections from Chiapas (e.g., Vol. Tacana, Matuda 2962 [MICH 3 sheets]) which differ somewhat from typical forms in having creeping stems, somewhat broader, darkly punctate, more elliptic leaves, otherwise they differ but little from other material of this species from Chiapas.

Richard Howard (1974) annotated the holotype of *Trevirania parviflora* as *Stemodia peduncularis* Benth., but the latter is a species of eastern México, as noted in the above.

REPRESENTATIVE SPECIMENS:

MEXICO. Chiapas: Mt. Ovando, Dec 1937, Matuda 2090 (GH, LL, MICH, PH, US). Guerrero: Distr. Mina, Río Frio, 21 Nov 1936, Hinton 9877 (G, GH, LL,

MICH,UC,US). Jalisco: 15-30 km N of Mascota, Sierra de San Sebastián, 1200-1300 m, 1-3 Mar 1970, Anderson 5986 (CAS,MEXU,MICH,TEX). México: Distr. Temascaltepec, Nanchititla, 15 Feb 1935, Hinton 7382 (LL). Michoacán: Coalcomán, 1000 m, 2 Jan 1939, Hinton 12924 (ARIZ,LL,MEXU,PH,TEX,US). Nayarit: near Villa Caranza, along route 28, 7 Jan 1979, Croat 45143 (MO).

GUATEMALA. Alta Verapaz: 2-4 km SW of Cobán, 1300-1400 m, 8 Feb 1969, Williams 40718 (DUKE,F). Zacapa: upper reaches of Río Sitio, 1500-1800 m, 25 Jan 1943, Steyermark 43197 (F,PH).

HONDURAS. Atlantida: near Tela, 20-600 m, 6 Dec 1927, Standley 54805 (F). Copán: 5 km SE of Santa Rosa de Copán, 29 Mar 1963, Molina 11665 (F,LL,US).

STEMODIA MARITIMA L.

Stemodia maritima L., *Syst. Nat.*, ed. 10, 2:1118. 1759. *Scordium marinum fruticosum procumbens, flore coeruleo* ... Sloane. 1696. *Stemodiaca maritima* (L.) P. Br., *Hist. Jamaica* 261. 1756. TYPE: JAMAICA: *Scordium marinum fruticosum procumbens, flore coeruleo* ... Sloane Houston s.n. (LECTOTYPE: BM! [selected here], mounted on same sheet with sprigs of *S. maritima* collected by Shakespear s.n. and Wright s.n.).

Stemodia maritima L. var. *rigida* J.A. Schmidt in Martius, *Fl. Bras.* 8:299. 1862. TYPE: BRAZIL: Pernambuco, seashore, Island of "Itamarica" [Itamaraca], Dec 1897, Gardner 1088 (LECTOTYPE: HBG? [selected here]; Isolectotypes: BM!, GH!). Specific locality and date from specimen at BM.

Stemodia piurensis Pennell, Not. Nat. Acad. Nat. Sci. Philadelphia 179:2. 1946. TYPE: PERU. Piura: river gravels, Quebrada Mogollon, Amotape Hill, 28-30 Mar. 1941, O. Haught & H.K. Svenson 11542 (HOLOTYPE: BKL!).

Stemodia fruticulosa Tsvelev, Bot. Zh. (Leningrad) 72:1663. 1987. TYPE: CUBA. Prov. Pinar del Río: Las Martinas, 10 May 1938, J. Acuña & J. Roig 10845 (HOLOTYPE: HAC; Isotype: HAC).

Suffruticose prostrate or sprawling glandular viscid perennial herbs, shrublets or shrubs mostly 0.3-1.5 m high. Stems erect to recumbent, variously pubescent with both long crisp uniseriate hairs and much shorter glandular trichomes. Midstem leaves ovate, lanceolate, or elliptical, sessile, mostly 1.5-3.0 cm long, 0.5-1.2 cm wide, clasping, subpinnately nervate, glandular viscid, the margins denticulate to entire. Flowers axillary, arranged 1 or 2 to a node, sessile, mostly covered by the leaves. Sepals 5, ± alike, linear lanceolate to

linear oblanceolate, more or less scarious along the margins, subtended by 1 or 2 basal bracts (rarely not). Corollas 2.5-5.0 mm long, more or less glabrous throughout, the lobes 1-3 mm long, sparsely pubescent. Anther thecae ca. 0.5 mm long, glabrous, both of these well separated by their slender stalks which are ca. 0.5 mm long. Style with an erect bilobed unexpanded stigmatic region. Capsules ovoid, 2-3 mm long, 4 valvate, the apices erect. Seeds ca. 0.4 mm long, ovoid, black, stipitate, ornamented with a crossmesh of raised ridges.

DISTRIBUTION (Figure 8). México (Quintana Roo) and Belize where perhaps introduced, West Indies and South America (Brazil and Perú; perhaps recently introduced to the latter), mostly occurring in saline beach sands and along estuaries in alluvial soils, 0-100 m; flowering all seasons.

Minod (1918) treated this taxon as the only member of the genus *Stemodiaca* P. Br., which predates *Stemodia*. If combined, *Stemodia* has legitimacy, being conserved. Because of the large number of specimens available only abbreviated citations are presented below.

The recently described *Stemodia fruticulosa* appears to be a late flowering form of the present species with somewhat smaller leaves (ca. 3-7 mm long vs. mostly 15-20 mm long).

REPRESENTATIVE SPECIMENS:

NORTH AMERICA: BELIZE. seashore, N of Manatee River, 1906, Peck 404 (GH); Turneffe, 1965, Stoddart 459 (US).

MEXICO: Quintana Roo: Mpio. Carillo Puerto, Mahahual, 1985, Cowan 5102 (TEX); Olmstead 5102 (MEXU); Cozumel, 1899, Millspaugh 1535 (F).

WEST INDIES: BAHAMA ISLANDS. Acklins: Brace 4418 (F). Andros: Brace 6734 (F). Cat Island: Hitchcock s.n. (F). Eleuthera: Lewis 7188 (MO). Exumas: Nickerson 2771 (A, MO). Grand Caymen: Sauer 4067 (F). Great Abaco: Sauleda 2292 (F). Great Exuma: Eldridge s.n. (MO). Inagua: Porter 33991 (A, MO, BER). Long Island: Eggers 4016 (US). Mayaguana: Wilson 7496 (F, MO). New Providence: Gillis 5348 (DUKE).

CURACAO. Arnoldo-Broeders 3755 (A); Potter 5120 (GH); Stoffers 310 (A).

CUBA. Camaguey, Schafer 635 (F); Habana, Wilson 2289 (F, US); Isle of Pines, Britton 25395 (F, MO, US); Las Villas, Webster 167 (A); Oriente, Ekman 2438 (US); Pinar del Río, Ekman 18792 (MICH).

DOMINICAN REPUBLIC. Abbott 1987, 1999 (US); Ekman 16537 (US); Zanoni 24790 (TEX).

HAITI. Ekman 8498 (G-DEL); Leonard 3536, 11768, 12822 (US).

STEMODIA PALMERI A. Gray

Stemodia palmeri A. Gray, Proc. Amer. Acad. Arts 21:403. 1886. TYPE: MEXICO. Chihuahua: near Batopilas, Aug-Nov 1885, E. Palmer 221 (LECTOTYPE: GH! [selected here]; Isotypes: K!, LE!, US!).

Annual or short lived perennial herbs mostly 20-40 cm high. Stems mostly pubescent with pilose hairs 1-2 mm long, often with shorter glandular trichomes intermixed, stems erect or ascending at first but with age much branched and procumbent at the base. Midstem leaves mostly 2-4 cm long, 1-2 cm wide; petioles mostly 8-18 mm long; blades ovate, subpinnately veined, epunctate, the margins irregularly crenulodentate. Flowers axillary, arranged 1 or 2 at a node, the peduncles ebracteate, mostly 2-3 cm long. Sepals ± alike, 6-8 mm long, sparsely pilose. Corollas mostly 12-16 mm long, blue to purple, the tubes sparsely pubescent, the lobes 2-4 mm long. Anther thecae ca. 0.5 mm long, separated by a globose connective. Capsule ovoid, ca. 5 mm high, 2 valvate, the apices erect. Seeds ca. 0.5 mm long, stipitate, longitudinally sulcate with 6-8 ribs.

DISTRIBUTION (Figure 8): Northwestern México (Sonora, Chihuahua, and N Sinaloa) in mostly dry short tree forests from 300-1800 m; flowering August-March.

This taxon is closely related to *Stemodia pusilla* but is readily separated by its more robust habit, larger leaves and much larger corollas (mostly 10-16 mm long vs. 6-10 mm).

REPRESENTATIVE SPECIMENS:

MEXICO. Chihuahua: Sierra Orejon, Río Mayo, 1 Jan 1935, Gentry 1212 (MICH). Sinaloa: Dept. de Badiraguato, Arroyo de Carrascal, 3000 ft, 4 Mar 1940, Gentry 5802 (ARIZ, DS, GH, MEXU, MICH, MO, UC). Sonora: Quirocaba, Río Fuerte, 7 Mar 1935, Gentry 1436 (ARIZ, GH, MO, PH).

STEMODIA PEDUNCULARIS Benth. in DC.

Stemodia peduncularis Benth. in DC., Prodr. 10:382. 1846. *Stemodiaca peduncularis* (Benth.) Kuntze, Rev. Gen. Pl. 2:466. 1891. TYPE: MEXICO. Veracruz: Mirador, 1838, J. Linden 1098 (LECTOTYPE: K! [selected here = the lower specimen - the upper specimen is a Galeotti collection]; Isolectotypes: G!, G-BOIS!, G-DC!, G-DEL!, LE!, MICH!). Bentham also cited the Galeotti collection in his protologue.

Suffruticose erect or scrambling perennial herbs (0.3-)0.8-1.0(-2.5) m high. Upper stems usually somewhat square and frequently with narrow wings along

the angles, pubescent with short puberulent hairs, mostly 0.5-1.0 mm long, the latter rarely interspersed with short glandular hairs. Midstem leaves mostly 3-6 cm long, 1.5-4.0 cm wide; petioles 1.0-1.5 cm long; blades broadly ovate, sparsely puberulent, especially along the veins, the undersurfaces markedly glandular punctate with amber to brown dots, the margins irregular crenulodentate. Flowers axillary, mostly arranged 2-4 at a node, the peduncles ebracteate, mostly 3-4 cm long, pubescent like the stems. Sepals mostly 6-8 mm long, puberulous and markedly glandular punctate like the leaves. Corollas mostly 12-15 mm long, reportedly white to blue, the tubes sparsely pubescent, the lobes 2-4 mm long. Anther thecae ca. 0.6 mm long, glabrous, separated by an ovoid connective ca. 0.4 mm across. Capsules broadly ovoid, 6-7 mm high, (3-)4 valvate, scarcely recurved apically. Seeds ca. 0.7 mm long, ellipsoid, stipitate, 6-8 sulcate.

DISTRIBUTION (Figure 9): Mostly eastern México from Hidalgo to Chiapas, and southwards to Panamá, mixed montane cloud forests, mostly 500-2000 m; flowering July-March.

This species is represented among the collections borrowed by 50 or more specimens from 20 or more localities, mostly from Veracruz, México. All of these are remarkably similar, possessing a short crisp puberulence on the stems and mostly lacking short glandular hairs as commonly occurs in its more western cohort, *Stemodia macrantha*. In addition the leaves of *S. peduncularis* have markedly brown or amber colored punctate glands on their undersurfaces, and often the calyx. Plants from Chiapas, México and Central America, tend to have somewhat smaller corollas on shorter peduncles, otherwise these are quite similar to typical material.

Stemodia peduncularis is readily distinguished from *S. macrantha* by its mostly shorter eglandular puberulence and markedly amber colored glandular punctate leaves and sepals.

REPRESENTATIVE SPECIMENS:

MEXICO. Chiapas: Mpio. Ocozocoautla, 4.9 km de Malpaso, ca. 140 m, 20 Jun 1980, Cowan 3065 (MEXU). Hidalgo: trail by Lake Atexa below Molango, 1400 m, 22 Mar 1947, Moore 2457 (GH). Oaxaca: Cañada de San Gabriel Etla, 2000 m, 8 Aug 1897, Conzatti 319 (GH). Puebla: Mpio. de Hueytamalco, El Reparo, 1050 m, 30 Jan 1970, Ventura 416 (DS,MEXU,MICH). Veracruz: Mpio. de Atzalán, Arroyo, 800 m, 12 Nov 1970, Ventura 510 (ARIZ,DS,ENCB,F, MICH).

CENTRAL AMERICA: COSTA RICA. Cartago: ca. 4.2 km NE of Torito, ca. 1500 m, 9 Mar 1978, Wilbur 25513 (DUKE). San José: ca. 3 km W of Coscajal, 17 Feb 1978, Almeda 3634 (CAS,MO).

GUATEMALA. Alta Verapaz: Cobán, 1350 m, Feb 1908, Tuerckheim II 1658 (C). Quezaltenango: Finca Helvetia, 3100 ft, 8 Oct 1934 (GH).

HONDURAS. Cortez: Montaña Santa Ana, 210 m, 6 Dec 1950, *Molina* 3598 (F).

PANAMA. Chiriquí: NE slopes of Cerro Pando, ca. 1500 m, 15 Jan 1970, *Wilbur* 11017 (DUKE,F,MICH,MO).

STEMODIA PUSILLA Benth.

Stemodia pusilla Benth., *Bot. Sulph.* 144. 1844. *Stemodiaca pusilla* (Benth.)

Kuntze, *Rev. Gen. Pl.* 2:466. 1891. TYPE: MEXICO. Nayarit: Tepic, w/o date, *Barclay s.n.* (HOLOTYPE: K!; Photoholotype: MICH!).

Stemodia humilis Pavon ex Minod, *Bull. Soc. Bot. Geneve*, ser. II, 10:197. 1918. TYPE: MEXICO. w/o locality; w/o date, *Sessé & Moçinno s.n.* [numbered 2853 on printed isotype label at F] (HOLOTYPE: G!; Isotypes: F!, OXF!). Minod reported the collector to be Pavon but the latter never collected in México. The sheets concerned were presumably in the Pavon herbarium; the isotypes match the holotype precisely and are annotated "*Stemodia littoralis*"; the holotype bears an annotation label that reads "*Stemodia humilis* herb. Pavon".

Weak stemmed semi-erect to prostrate annual herbs 5-20 cm high. Stems usually much branched from the base, pubescent with widely spreading mostly crinkly multiseptate trichomes 1-2 mm long, these often intermixed with glandular tipped hairs. Midstem leaves mostly 1.5-2.5 cm long, 0.8-1.2 cm wide; petioles mostly 3-9 mm long; blades ovate to subdeltoid, subpalmately nerved, epunctate, sparsely pubescent, the margins irregularly crenulodentate. Flowers axillary, arranged 1-2 at a node, the peduncles ebracteate, mostly 3-8 mm long. Sepals mostly 3-4 mm long, pilose, one of these somewhat different than the rest. Corollas 6-10 mm long, purplish to blue with yellow throats, the tube sparsely pubescent, the lobes 1-3 mm long. Anther thecae ca. 0.4 mm long, glabrous, separated by an ovoid connective. Capsule ovoid, 4-5 mm high, 2 valvate, the apices erect. Seeds ca. 0.4 mm long, ellipsoid, stipitate, longitudinally sulcate with 6-8 ribs.

DISTRIBUTION (Figure 10): Coastal regions of northwestern México from Colima to N Sinaloa with outlier populations in the Cape Region of Baja California, 100-400 m; flowering May-September.

This species is closely related to *Stemodia jorullensis* and *S. palmeri*. It differs from *S. palmeri* in having generally smaller corollas (6-10 mm long vs. 12-16 mm) and smaller leaves with shorter petioles (3-9 mm vs. 8-18 mm). Populations from the Cape Region of Baja California differ from mainland populations in having somewhat larger corollas (8-10 mm long vs. 6-8 mm); otherwise these differ but little from typical *S. pusilla*.

Minod treated Central American elements of *Stemodia angulata* within this taxon. He also cited a collection of *S. pusilla* from San Bernando Canyon, California, presumably introduced, which we have not examined.

REPRESENTATIVE SPECIMENS:

MEXICO. Baja California Sur: Arroyo San Pedro at Rancho Cayuco, moist sand along stream, 1000 ft, 7 May 1959, Thomas 7806 (CAS,DS,MEXU). Colima: w/o locality, 9 Jan-6 Feb 1891, Palmer 1252 (K). Jalisco: Cerro de la Cruz, 20 m, 27 Nov 1926, Mexia 1152 (CAS,G,GH,MICH,MO,UC). Nayarit: San José del Conde, ca. 1000 m, in wet sand, 29 Mar 1927, Mexia 1931 (CAS,F,G,GH,MO,UC). Sinaloa: Villa Unión, Jan 1895, Lamb 439 (DS,F,GH,MO).

STEMODIA SCHOTTII Holzinger

Stemodia schottii Holzinger, Contr. U.S. Nat. Herb. 286. 1893. TYPE: UNITED STATES. Texas: Starr Co., Rio Grande City, 1853, A. Schott s.n. (LECTOTYPE: US! [selected here]; Photolectotypes: F!, GH!, UC). In his original description Holzinger cited two collections, the lectotype and Nealley 305 (US) from Val Verde Co., Texas. Pennell (1935) indirectly selected the lectotype, formalized here; he also noted that a presumed isolectotype (F!) gives collection data as Ringgold Barracks [Starr Co.], beach of the Bravo del Norte [Rio Grande], 29 May 1893, Schott 28. The latter collection is probably an isolectotype, but this is not certain.

Stemodia purpusii Brandegee, Univ. Calif. Publ. Bot. 4:189. 1911. TYPE: MEXICO. Coahuila: Movano, Jun 1910, C.A. Purpus 4456 (HOLOTYPE: UC!; Isotypes: F!, G!, GH!, US!).

DISTRIBUTION (Figure 10): Northeastern México and closely adjacent U.S.A. (Texas), mostly in silty or clay, alluvial soils, 5-1000 m; flowering October-April.

Annual or short lived perennial herbs 5-25 cm high. Stems erect at first but soon much branched and recumbent at base, densely glandular pubescent with short hairs 0.2 mm long or less. Midstem leaves sessile, thickish, mostly 10-30 mm long, 5-12 mm wide, obovate to oblanceolate, auricled at the base, weakly pinnately nerved, if at all, the surfaces glandular pubescent like the stems, the margins denticulate. Flowers axillary, arranged 1 or 2 at a node, the peduncles glandular pubescent, bracteate, mostly 2-6 mm long. Sepals ± alike, 4.5-6.5 mm long, glandular pubescent, subtended by 1 or 2 basal bracts, the latter somewhat shorter than the sepals. Corollas mostly 10-13 mm long,

blue to purple, the tube minutely pubescent, the lobes 2-4 mm long, not strongly 2 lipped. Anther thecae glabrous, purple, ca. 0.5 mm long, separated by a globose connective. Capsules ovoid, 5-6 mm high, 4 valvate, the apices erect or nearly so. Seeds ovoid, stipitate, ca. 0.3 mm long, the surfaces with scattered minute warts, arranged in ca. 12 longitudinal lines.

Plants from the more eastern parts of Texas and Tamaulipas tend to have somewhat larger thinner leaves than those to the west, to which the name *Stemodia purpusii* has been applied, otherwise there is relatively little variation in the taxon.

REPRESENTATIVE SPECIMENS:

UNITED STATES. Texas: Cameron Co.: In open fields, Arroyo Colorado Bridge, 19 Mar 1937, *Runyon* 1614 (TEX,US). Hidalgo Co.: 5 mi N of McAllen, 29 Feb 1944, *Painter* 14469 (TEX). La Salle Co.: open ground near river, Cotulla, 16 Mar 1917, *Palmer* 11296 (MO,PH,UC,US). Starr Co.: 10.7 mi NE of Rio Grande City on road 755, 9 Oct 1954, *Tharp* 541901 (CAS,LL,TEX). Val Verde Co.: just E of Langtry, rim rock above Mile Canyon, overflow area near windmill, 29 Apr 1979, *Johnston* 12449 (TEX). Webb Co.: sandbars of Rio Grande, near Laredo, Aug 1899, *Mackenzie* 90 (PH).

MEXICO. Coahuila: 7.5 mi W of Nuevo Rosita, ca. 1500 ft, 11 Jun 1955, *Johnston* 2568 (TEX). Durango: 1.5 mi NW of Yermo, 4 May 1959, *Correll* 21443 (LL). Nuevo León: Battlefield between Citadel and Teneria, 29 Jan 1847, *Gregg* 194 (MO). Tamaulipas: 4-5 mi S of Cd. Mante, 18 Feb 1961, *King* 3784 (MICH,TEX,UC). Veracruz: 3 km N of Chijol, 26 Jan 1970, *Gomez-Pompa* 4760 (MEXU).

STEMODIA TENUIFOLIA Minod

Stemodia tenuifolia Minod, Bull. Soc. Bot. Geneve, ser. II, 10:185. 1918.

TYPE: MEXICO. w/o state or locality, w/o date, *Sessé & Moçiño* s.n. (?) (HOLOTYPE: G-DC; Photoholotypes: F!, GH!, MO!). Minod thought the type was collected by Pavon; actually the sheet concerned was probably a collection of Sessé which was part of the Pavon herbarium, much as explained for *Stemodia neglecta* Minod, cf. *S. jorullensis* (although no handwriting validates the interpretation offered here, the type matches material from México and Michoacán, a region where the collectors visited, and duplicates of Sessé & Moçiño collections were known to be in the Pavon herbarium, some of which reside at G).

Prostrate or sprawling perennial herbs 15-45 cm high, sometimes with slender rhizomes, these forming small patches or colonies. Stems pilose with

crinkly spreading multiseptate hairs 1 mm long or more. Midstem leaves 2 or 3 to a node, mostly 1.5-2.5 cm long, 1.0-2.5 cm wide; petioles 2-6 mm long; blades broadly ovate to ovate-elliptic, sparsely pilose, especially along the veins, the lower surfaces weakly glandular punctate, the margins rather evenly crenulodentate. Flowers axillary, arranged 2-4 at a node, the peduncles ebracteate, 1-6 mm long, sparsely pilose. Sepals ± alike, 6-8 mm long, pilose, linear-lanceolate. Corollas ca. 8 mm long, sparsely pilose, white or whitish, the tubes greenish yellow within, the lobes 1-2 mm long. Anther thecae glabrous, ca. 0.5 mm long, separated by an oval connective ca. 0.2 mm across. Capsule broadly ovoid, ca. 6 mm high, 4 valvate, the apices erect. Seeds ca. 0.8 mm long, ellipsoid, stipitate, longitudinally sulcate with 6-8 ribs.

DISTRIBUTION (Figure 11): Western México in montane areas along Pacific slopes in pine forests, 1100-1700 m; flowering August-November.

Because of its low sprawling perennial habit, relatively short broad leaves and very short peduncles, a relatively easily identified taxon. It seems clearly related to *Stemodia chiapensis* in nearly all of its characters except those discussed under the latter.

SPECIMENS EXAMINED:

MEXICO. Jalisco: Sierra del Halo, near a lumber road leaving the Colima highway 7 mi SSW of Tecalitlán and extending SE toward San Isidro, 3 mi from the highway in red clay soil on steep slopes, 1530 m, 14 Aug 1957, McVaugh 16177 (MICH); 11-12 km SW of Tecalitlán, 1600-1650 m, 19 Nov 1970, McVaugh 24480 (MICH); 16-18 km ENE of Cuautitlán, 1750 m, 27 Nov 1988, Santana 4213 (WIS). México: Temascaltepec, Acatitlán, 1130 m, 16 Nov 1933, Hinton 5218 (K). Michoacán: foothills of Cerro Tancitaro, NW slopes, 6-7 km S of Peribán de Ramos, 1600 m, 29 Nov 1970, McVaugh 24856 (MICH).

STEMODIA VERTICILLATA (Miller) Hassler

Stemodia verticillata (Miller) Hassler, *Contr. Fl. Chaco.* 110. 1909. BASIONYM: *Erinus verticillatus* Miller, *Gard. Dict.*, ed. 8. 1768. *Stemodia parviflora* W.T. Aiton, *Hortus Kew.*, ed. 2. 4:52. 1812 (based upon *Erinus verticillatus* Miller). *Stemodiandra verticillata* (Miller) Kuntze, *Rev. Gen. Pl.* 2:466. 1891. *Lindernia verticillata* (Miller) Britton in Britton & Wilson, *Bot. Porto Rico* 6:184. 1925. TYPE: MEXICO. Veracruz: 1731, Houstoun s.n. (HOLOTYPE: BM!).

Capraria humilis Solander in W.T. Aiton, *Hortus Kew.*, ed. 2:46. 1789.

Lindernia humilis (Solander) Minod, *Bull. Soc. Bot. Geneve*, ser. II 10:241. 1918. *Stemodia humilis* (Solander) Dawson, *Rev. Mus.*

La Plata, Sec. Bot. 8:14. 1956. (Not *Stemodia humilis* Pavon ex Minod, 1918). TYPE: East Indies, 1781, Sir Joseph Banks s.n. (HOLOTYPE: K).

Stemodia arenaria H.B.K., Nov. Gen. Pl. 2:357. 1817. TYPE: COLOMBIA. "Crescit in ripa mundata fluminis Magdalenae prope Banco", 1801, Humboldt & Bonpland s.n. (LECTOTYPE: P [selected here]).

?*Poarium veronicoides* Desvaux ex Hamilton, Prodr. Pl. Ind. Occ. 46. 1825. TYPE: DOMINICAN REPUBLIC [Hispaniola]: w/o specific locality, w/o date, Desvaux s.n. (HOLOTYPE: P).

Stemodia macrotricha Colla, Herb. Pedem. 4:327. 1835. TYPE: BRAZIL: "Arenosis ad Rio Belmonte", w/o date, Martins s.n. (HOLOTYPE: TO).

Herpestis diffusa Willd. ex Cham. & Schlecht., Linnaea 3:6. 1878. TYPE: Herb. Willd. 11444 (B-WILLD, Microfiche!). Cited in synonymy.

Erect or sprawling rather delicate annual herbs 5-25 cm high. Stems variously pubescent with both glandular or eglandular pilose hairs. Midstem leaves mostly 10-18 mm long, 6-14 mm wide; petioles 5-10 mm long, pilose, grading into the blades; blades ovate, subpalmately nervate, pilose, the surfaces inconspicuously punctate, the margins crenulodentate. Flowers axillary, arranged 2-4 at a node, the pedicels ebracteate, mostly 1-2 mm long. Sepals 5, ± alike, 3-4 mm long, pilose. Corollas 2-3 mm long, blue to purplish, the tubes nearly glabrous, 2 lipped, the lobes ca. 1 mm long, sparsely pubescent. Anther thecae glabrous, ca. 0.2 mm long, separated by an enlarged connective ca. 0.3 mm across. Capsules nearly globose, mostly 1.5-2.0 mm high, 2(-4) valvate, the apices erect. Seeds broadly obpyramidal to ellipsoid, ca. 0.5 mm long, stipitate, longitudinally sulcate with 6-8 ribs. Chromosome number, $2n = 22$.

DISTRIBUTION (Figures 12, 13): Widespread and common weed throughout most of tropical America; flowering all seasons.

This is an easily recognized weedy species. Minod (1918) treated it as the only member of the genus *Lindernia*. Because of the 2000 or more sheets available in many herbaria we have abbreviated the citations that follow.

REPRESENTATIVE SPECIMENS:

MEXICO. Chiapas: Breedlove 16160 (CAS,F). Colima: Palmer 1178 (GH). Guerrero: Hinton 6010 (GH). Hidalgo: Seler 628 (GH). Jalisco: Mexia 1886 (CAS,US). México: Hinton 2966 (F,GH,MEXU,MO,PH,US). Oaxaca: Martínez 407 (GH). Tabasco: Cowan 4665 (TEX,MEXU). Veracruz: Purpus 2444 (F,GH,MO,UC).



Figure 12. Distribution of *Stemodia verticillata* in West Indies and Central America.



Figure 13. Distribution of *Stemodia verticillata* in México.

CENTRAL AMERICA: COSTA RICA. Cartago: *Holm* 69 (A, PH). Guanacaste: *Morley* 757 (F). Heredia: *Grayum* 1771 (DUKE). Limón: *Cowan* 4574 (TEX). Puntarenas: *Wilbur* 27615 (DUKE). San José: *Cowan* 4530 (TEX).

EL SALVADOR. Ahuachapán: *Standley* 20259 (GH). Santa Ana: *Standley* 3124 (F).

GUATEMALA. Alta Verapaz: *Steyermark* 46320 (F). Chiquimula: *Standley* 71930 (F). Escuintla: *Standley* 64599 (F). Izabal: *Standley* 24070 (F). Jutiapa: *Standley* 75822 (F). Petén: *Lundell* 3415 (TEX). Quezaltenango: *Standley* 67891 (F). Retalhuleu: *Standley* 88377 (F). Sacatepequez: *Steyermark* 60843 (F). Santa Rosa: *Standley* 77809 (F). Solola: *Steyermark* 47493 (F).

HONDURAS. Atlantida: *Standley* 54302 (F). El Paraiso: *Standley* 26998 (F). Morazán: *Standley* 18865 (F). Olancho: *Standley* 17615 (F). Yoro: *Hernández* 1065 (MO).

CONTROVERSIAL AND EXCLUDED NAMES (for the area concerned)

Schistophragma intermedia (A. Gray in Torr.) Pennell - Keil (pers. comm.) would position this taxon in his concept of *Leucospora*. We believe it should remain where Pennell positioned it.

Schistophragma mexicana D. Dietr. This is the generitype of *Schistophragma*. Keil (pers. comm.) would position this taxon along with *S. intermedia* in his concept of *Leucospora*. We believe both species, along with *S. polystachya*, should be retained within *Schistophragma*.

Schistophragma pusilla Benth. = *Schistophragma mexicana* D. Dietr.

Stemodia coahuilensis (J. Henr.) B.L.Turner, *comb. nov.* - based upon *Leucospora coahuilensis* J. Henr., Aliso 12:435. 1989. This taxon is closely related to *Stemodia multifida*, as noted by its original author. For additional comments see *S. multifida*, below.

Stemodia costaricensis B.L. Turner = *Darcya costaricensis* (B.L. Turner) B.L. Turner (in prep.).

Stemodia multifida (Michx.) Spreng. = *Leucospora multifida* (Michx.) Nutt. In the senior author's opinion this taxon belongs within his concept of *Stemodia* (s.l.). It has no unique features which might distinguish it from yet other species of the group; this is discussed in more detail in our discussion of generic relationships. Keil (pers. comm.) is currently undertaking a systematic study of *Leucospora* and has retained the latter, within which he positions the very different *Schistophragma*. So treated,

Leucospora would be grossly aphyletic. Since Keil's work is awaiting publication, and because he has had most of the materials concerned on loan for some time, we have not included *Leucospora*, sensu Keil, in our treatment, which is of little moment since only two closely related taxa are involved.

Stemodia polystachya Brandegee, Proc. Calif. Acad., ser. 2, 2: 1889. = *Schistophragma polystachya* (Brandegee) B.L. Turner, *comb. nov.*

Stemodia radicans Griseb. = *Chelophyllum radicans* (Griseb.) Pennell.

Stemodia reliquiarum D'Arcy = *Darcya reliquiarum* (D'Arcy) B.L. Turner (in prep.).

Stemodia siliquosa Sessé & Moçiño = *Schistophragma mexicana* D. Dietr.

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ERIOCAULON NIGROBRACTEATUM (ERIOCAULACEAE), A NEW SPECIES FROM THE FLORIDA PANHANDLE, WITH A CHARACTERIZATION OF ITS POOR FEN HABITAT

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ABSTRACT

Eriocaulon nigrobracteatum is described as a new species restricted to deep sapric muck soils of weakly oligotrophic poor fens in the Gulf Coastal Lowlands of the eastcentral Florida panhandle, where it is currently known from Bay, Calhoun, and Gulf counties. It is most similar to *Eriocaulon septangulare* With. of the northern United States, and is distinguished by its generally smaller stature and floral parts, and its exposed dark gray involucral bracts on mature heads. A key is provided to distinguish *E. nigrobracteatum* from other species of *Eriocaulon* in eastern North America. The phenology and narrowly endemic distribution of *E. nigrobracteatum* are discussed. Associated vascular plant taxa and an ecological description of its poor fen habitat are provided.

KEY WORDS: *Eriocaulon nigrobracteatum*, Eriocaulaceae, Florida, poor fens, floristics

In March of 1991, while surveying the flora of sapric seepage herb communities in the Florida panhandle, an unusual, diminutive *Eriocaulon* with fully mature inflorescences was collected from several sites in Bay County. Some of these sites were revisited in early April 1991, and specimens were collected and maintained alive through mid-May in order to observe any changes in their unusually small, dark heads and diminutive stature. In March of 1992

after having identified potential habitat for this plant from black and white aerial photographs (1:24,000) of adjacent Gulf and Calhoun counties, we conducted additional field surveys, which resulted in several sites being located in these counties. Detailed examination revealed several distinct characters which were consistent throughout the growth cycle of the plant, and we became convinced it represented an undescribed, endemic species. A search of the following herbaria (FLAS,FSU,USF,TEX) failed to uncover any specimens of *E. nigrobracteatum*, previous to our collections. The objectives of this paper are: 1) to describe the new species of *Eriocaulon*; and 2) to describe its poor fen habitat.

***Eriocaulon nigrobracteatum* Bridges & Orzell, sp. nov.** TYPE: UNITED STATES. Florida: Bay County: Deep muck quaking seepage herbaceous bog (poor fen) in valley of Sandy Creek, ca. 2.6 mi S of FL 22 jct on both sides of Sandy Creek Road, just N of Alvie Holmes Rd. jct., E of Mule Creek, ca. 0.2 air mi NE of Mule Creek and Sandy Creek jct., ca. 8.5 air mi ESE of Callaway; NEQ, SWQ, SWQ, Sec. 23, T4S, R12W; Allanton 7.5' Quad.; 30°07'00" N, 85°25'14" W; Elev. 13 ft.; 9 Apr 1991, Orzell & Bridges 16302 (HOLOTYPE: TEX; Isotypes: FLAS,GH,MO,NCU,NY,USF). Figures 1-4.

Herba perennis dense caespitosa. Folia rosulata, e basi albedo viridescentia, lineari-attenuata 0.5-1.5(-4.0) × 0.3-1.0 mm, irregulariter incomplete septata. Scapi ocrea folia multo superans, 1.5-2.0(-4.9) cm longa, ore aperto obliquo bifido. Scapus maturus filiformis 5-15(-19) cm longus, 0.2-0.3 mm diam., spiraliter tortus, plerumque 4-carinatus. Capitula matura hemisphaerica 3-4 (-5) mm diam, inferne fusco-nigricantia superne albedo. Receptaculum laeve. Involucre bracteate exteriores late ovatae vel orbiculares 1.0-1.3 x 0.9-1.2 mm, apice obtusae integrae, fusco-nigricantes. Receptaculi bracteolae ± 1 mm, late ovatae, aut omnino fusco-griseae aut basi pallescentes, ad apicem dorso margineque pilis clavatis dense obsitae. Flos masculinus: sepala griseo-translucida, oblonga circa 1.2 mm, curvato-concava, obscure carinata, apice rotundata, extus ad apicem et margine superiori pilis clavatis obsita. Petala inter se subaequilonga, pallida, cylindrum angustum ± 1.1 mm longum acutum efformantia, intus circa glandulas et ad margines pilis clavatis albis provisa. Antherae nigrae, late ellipsoideae ± 0.2 mm longae, vix vel haud exsertae, filamentis albis brevibus. Flos foemineus: sepala oblonga, parum curvato-carinata ± 1 mm longa, griseo-translucida, dorso et margine superiori pilis clavatis ciliata. Petala oblonga ± 1 mm, obtusa, intus et secus margines ultra

medium pilis clavatis obsita, superficie interna etiam trichomatibus elongatis multicellularibus translucidis pilosa; capsula pallida brunnea bicarpellata $\pm 0.3 \times 0.6\text{--}0.7$ mm; semina orbicularia ± 0.3 mm diam, obscurissime reticulata.

Perennial, forming large dense clumps by basal offshoots. Leaves in a basal rosette, whitish below, dark green above, linear-attenuate, 0.5-1.5(-4.0) cm long, 0.3-1.0 mm wide, irregularly and incompletely septate, tapering evenly from a pale, aerenchymatous base. Sheath of scape much longer than the leaves, 1.5-2.0(-4.9) cm long, the orifice loose, oblique, hyaline, bifid. Mature scape delicately filiform, light green, 5-15(-19) cm long, 0.2-0.3 mm broad, strongly twisted, mostly 4 ridged. Mature heads hemispherical, sometimes globose when pressed, 3.0-4.0(-5.0) mm broad, dark gray to black below due to the exposed involucral bracts, white above due to the densely white-hairy tips of the perianth parts and bractlets. Surface of the receptacle smooth. Outer involucral bracts broadly ovate to orbicular, 1.0-1.3 mm long, 0.9-1.2 mm wide, smooth, dark gray to black, the tips rounded, entire. Receptacular bractlets about 1.0 mm long, broadly ovate, uniformly dark gray or slightly lighter yellowish or whitish at base, the apex densely white clavate hairy on the back and margin. Male flower: sepals gray-translucent, oblong, ca. 1.2 mm long, concave-curve, obscurely keeled, the apex rounded, the outer apex and upper margin densely white clavate hairy. Petals subequal, pale, largely found in a narrowly cylindrical structure about 1.1 mm long, acute, the inner surface around the glands and the margins of the petal lobes with white clavate hairs. Anthers black, broadly ellipsoid, ca. 0.2 mm long, very slightly exserted or not exerted from the head on short white filaments. Female flower: sepals oblong, slightly curvate-keeled, ca. 1.0 mm long, gray-translucent, white clavate on the back and upper margin. Petals oblong, ca. 1.0 mm long, obtuse, the upper inner surfaces and upper margins white clavate hairy, the inner surface also densely hairy with long, clear, multicellular trichomes, capsule light brown, bicarpellate, 0.6-0.7 mm wide, ca. 0.3 mm high, seeds orbicular, ca. 0.3 mm long, very obscurely reticulate.

Flowering in March and April, with mature seeds in April and May; scapes and inflorescences scarcely or not at all visible in other seasons.

Additional collections (Paratypes): UNITED STATES. Florida: Bay Co.: same as type locality, 13 Mar 1991, *Orzell & Bridges 16109* (FTG, GA, GH, NCU, NY, S, TEX); Deep muck quaking seepage herbaceous bog (poor fen), near transmission line r-o-w, on slope just NW of r-o-w crossing on Little Sandy Creek, ca. 0.8 air mi upstream from mouth at Sandy Creek, ca. 6.7 air mi NE of Farndale; SEQ, NWQ, NWQ, Sec. 36, T4S, R12W, Allanton 7.5' Quad.; $30^{\circ}05'47''$ N, $85^{\circ}24'12''$ W; Elev. 13-20 ft.; 9 Apr 1991, *Orzell & Bridges 16306* (FLAS, MO, NCU, NY, TEX, USF), 13 Mar 1991, *Orzell & Bridges 16103* (FTG, GA, GH, TEX, US); Streamhead seepage bog (poor fen) on N side of FL

20, 0.4 mi W of int. with US 231, ca. 3 mi SSW of Fountain and 5 mi N of Youngstown; SEQ, SWQ, SWQ, Sec. 34, T1N, R12W; Fountain 7.5' Quad.; 30°26'12" N, 85°26'03" W; Elev. 140-150 ft.; 13 Mar 1991, *Orzell & Bridges* 16104 (TEX); Seepage bog (poor fen), W of Bay - Gulf Co. line Rd., on N side of Little Sandy Creek, ca. 6.5 air mi NE of Allanton; NEQ, NEQ, SEQ, Sec. 36, T4S, R12W; Allanton 7.5' Quad.; 30°05'30" N, 85°23'27" W; Elev. 13-19 ft.; 13 Mar 1991, *Orzell & Bridges* 16105 (FLAS,NCU,TEX,US,USF); Sapric lower slope seepage bog (poor fen), in valley E of sand road, ca. 1.2 air mi W of US 231 at Fountain, in headwaters of Bear Creek, ca. 2 air mi N of FL 20; EH, NWQ, NEQ, Sec. 28, T1N, R12W; Fountain 7.5' Quad.; 30°27'48" N, 85°26'35" W; Elev. 150-160 ft.; 30 Mar 1992, *Orzell, Bridges, & Hilsenbeck* 19283 (FSU,SMU,TEX); Quaking, mucky seepage bog (poor fen) above tidally influenced creekside marsh, on W side of timber rd., just N of bridge over Little Sandy Creek, ca. 1.1 mi W of Gulf Co. line and 0.6 mi upstream from Sandy Creek, ca. 6.5 air mi NE of Farndale; SEQ, NEQ, NEQ, Sec. 35, T4S, R12W; Allanton 7.5' Quad.; 30°05'42" N, 85°24'22" W; Elev. 7-10 ft.; 30 Mar 1992, *Orzell, Bridges, & Hilsenbeck* 19289 (Tall Timbers,TEX). **Calhoun Co.:** Lower slope deep muck seepage bog (poor fen), on N side of East Prong just ENE of jct with Bear Creek near Bay - Calhoun Co. line, ca. 12.2 air mi WSW of Clarksville; NWQ, NWQ, Sec. 7 and SWQ, Sec. 6, T1S, R11W; Fountain 7.5' Quad.; 30°25'10" N, 85°23'01" W; Elev. 98-111 ft.; 20 Mar 1992, *Orzell & Bridges* 19252 (FLAS,FTG,GA,GH,MICH,MO,NCU,NY,TEX,USF); Mid-slope deep muck seepage bog (poor fen), along unnamed tributary draining NE into Juniper Creek, ca. 6.2 air mi NW of FL 20 bridge over Juniper Creek, ca. 13.7 air mi W of Clarksville; NWQ, SWQ, NEQ and NEQ, SEQ, NWQ, Sec. 30, T1N, R11W; Juniper Creek 7.5' Quad.; 30°27'33" N, 85°29'52" W; Elev. 144-157 ft.; 20 Mar 1992, *Orzell & Bridges* 19259 (NCU,TEX,USF). **Gulf Co.:** Lower slope seepage herb bog (poor fen), on E side of Wetappo Creek, ca. 5 air mi S of FL 22 bridge over Wetappo Creek, ca. 6 air mi SW of Wewahitchka; WH, SEQ, Sec. 36, T4S, R11W; Wetappo Creek 7.5' Quad.; 30°05'19" N, 85°17'47" W; Elev. 20-26 ft.; 21 Mar 1992, *Orzell & Bridges* 19271 (FLAS,FTG,GA,GH,MICH,MO,NCU,NY,TEX,US,USF); Lower slope mucky seepage bog (poor fen), on N side of Little Sandy Creek (Alligator Creek), ca. 0.4 air mi E of Creek crossing of Bay-Gulf Co. line, ca. 13 air mi W of Wewahitchka; NEQ, SWQ, Sec. 31, T4S, R11W; Allanton 7.5' Quad.; 30°05'23" N, 85°23'03" W; Elev. 13-19 ft.; 21 Mar 1992, *Orzell & Bridges* 19278 (NCU,TEX,USF); Lower slope, deep muck, quaking seepage bog (poor fen), on W side of Little Sandy Creek (Alligator Creek), ca. 0.6 air mi NE of creek crossing at Bay-Gulf Co. line, ca. 13 air mi W of Wewahitchka; NWQ, SWQ, NEQ and NEQ, SEQ, NWQ, Sec. 31, T4S, R11W; Allanton 7.5' Quad.; 30°05'43" N, 85°22'54" W; Elev. 19-26 ft.; 21 Mar 1992, *Orzell & Bridges* 19276 (FLAS,MO,TEX,USF).

TAXONOMIC RELATIONSHIPS

Eriocaulon nigrobracteatum, among North American species of *Eriocaulon*, is closest in appearance to *E. septangulare* With. (= *E. articulatum* Morong, *E. aquaticum* [Hill] Druce, *E. pellucidum* Michx.), a bog and lakeshore species primarily found from the Canadian Shield south to the Great Lakes region, New England, and southward near the Atlantic coast to eastern North Carolina (Moldenke 1937; Kral 1966, 1989). Disjunct locations of *E. septangulare* are found in Great Britain, the Ridge and Valley Province of Augusta County, Virginia, and questionably in the Blue Ridge Province of Henderson County, North Carolina. *Eriocaulon nigrobracteatum* is distinguished from smaller specimens of *E. septangulare* by its involucral bracts which are not reflexed and are consistently and conspicuously uniformly dark gray even on mature heads, its consistently smaller flower parts, averaging only 2/3 the size of the corresponding parts of *E. septangulare*, and its smaller, orbicular rather than ovate, seed which is reticulate rather than striate. Additionally, the maximum size of the leaves, scapes, and heads of *E. septangulare* are not approached by *E. nigrobracteatum*, although smaller or immature specimens of *E. septangulare* may be a similar size. The glabrous receptacle clearly distinguishes this species from *E. decangulare* L., *E. compressum* Lam., and *E. texense* Körn., and the dark gray conspicuous involucral bracts and small stature distinguish it from *E. lineare* Small. *Eriocaulon nigrobracteatum* would key imperfectly in Kral (1966) and Godfrey & Wooten (1979) to either *E. ravenelii* Chapm. or *E. kornickianum* van Huerck & Muell.-Arg., both quite different species which do not form the dense, long lived clumps of *E. nigrobracteatum*. Additionally, *E. ravenelii* lacks white clavate hairs on the floral parts and *E. kornickianum* has stramineous outer involucral bracts. *Eriocaulon nigrobracteatum* seems to be consistently the most diminutive *Eriocaulon* in eastern North America north of México. The size of the leaves, scape, and head are reminiscent of *Lachnocaulon digynum* Körn., but it is easily distinguished from this bicarpellate *Lachnocaulon* by its fleshy, unbranched, septate roots, septate leaves with lacunar tissue, dark gray involucral bracts, glabrous receptacle, white clavate trichomes on the floral parts, and black anthers.

The following key (adapted from Kral (1966) and Kral in Godfrey & Wooten (1979) can be used to distinguish *Eriocaulon nigrobracteatum* from other species of *Eriocaulon* in eastern North America:

1. Heads large, seldom less than 1 cm broad in flower or fruit, scapes seldom shorter than 2 dm tall, leaves seldom shorter than 5 cm long. 2
1. Heads smaller, rarely more than 0.7 mm broad in flower or fruit, scapes rarely as long as 2 dm (except when plants are deeply submersed), leaves usually less than 5 cm long (except when submersed). 3

2. Heads hard when mature, leaves usually exceeding sheath of scape; involucral bracts stramineous, acute. *E. decangulare* L.

2. Heads soft and easily compressed even when mature, leaves shorter than sheath of scape; involucral bracts grayish, rounded. *E. compressum* Lam.

3. Surface of the receptacle and/or bases of the florets with many long, narrow, multicellular, translucent trichomes; perianth parts and receptacular bractlets with white clavate trichomes. *E. texense* Körn.

3. Surface of the receptacle glabrous or but sparsely trichomiferous; perianth parts and receptacular bractlets either smooth or with white clavate trichomes. 4

4. Stamens 6, carpels 3 on an elongate gynophore (rare adventive in Louisiana rice fields). *E. cinereum* R. Br.

4. Stamens 4, carpels 2 on a short gynophore (widespread in eastern United States). 5

5. Perianth parts and receptacular bractlets with copious white clavate trichomes, thus the upper parts of the heads conspicuously whitened; plants typically forming large clumps by short lateral offshoots or short rhizomes. 6

5. Perianth parts and receptacular bractlets with few or no white clavate trichomes, thus the upper parts of the heads gray or gray and white banded; plants generally solitary or in small, short lived clumps. 8

6. Outer involucral bracts and most receptacular bracts and sepals whitened or stramineous, thus the lower parts of the heads pale even when young; plants of sandy or peaty lake or pond margins in south Georgia, Florida, and south Alabama *E. lineare* Small

6. Almost all involucral bracts and all receptacular bracts and sepals darkened, gray to black, thus the lower parts of the heads dark when young; plants widespread in eastern Canada and northern United States, or restricted to seepage bogs (poor fens) in the southern United States. 7

7. Leaves 1-8 cm long; mature scapes 4-21 cm long (or longer when submerged), linear, ca. 1 mm broad; mature heads 4-5 mm broad; involucral bracts gray, reflexed and hidden by the florets on mature heads; sepals ca. 1.5 mm long, petals ca. 1.2-1.5 mm long; seed ovoid, ca. 0.5 mm long. *E. septangulare* With.

7. Leaves 0.5-1.5(-4.0) cm long; mature scapes 5-15(-19) cm long, delicately filiform, 0.2-0.3 mm broad; mature heads mostly 3-4 mm broad (rarely to 5 mm when pressed); all involucral bracts dark gray to black, not reflexed or hidden even on mature heads; sepals 1.0-1.2 mm long, petals 1.0-1.1 mm long; seed orbicular, ca. 0.3 mm long.
..... *E. nigrobracteatum* Bridges & Orzell

8. Receptacular bractlets stramineous or gray, often erose or lacerate, broadly acute to obtuse; scapes linear; plants of estuarine areas of the central and northern Atlantic coast. *E. parkeri* B.L. Robinson

8. Receptacular bractlets very dark and lustrous, subentire and narrowly acute; scapes filiform; plants of the southeastern and south-central United States. 9

9. All perianth parts dark, smooth or rarely with a few white clavate trichomes on the inner surface of the female petals; involucral bracts all gray; seed rectangular reticulate, the lines farinose; plants of the outer coastal plain of Florida (and one collection in South Carolina).
..... *E. ravenelii* Chapm.

9. Perianth parts with some white clavate trichomes on the margins, thus the heads gray and white banded; outer involucral bracts stramineous; seed papillate or rugose; plants of rock outcrops and seepage areas in Georgia, Arkansas, Oklahoma, and Texas.
..... *E. kornickianum* van Huerck & Muell.-Arg.

DISTRIBUTION AND ECOLOGY

Eriocaulon nigrobracteatum is a narrow endemic currently known from eleven sites in eastern Bay (6), and adjacent western Calhoun (2) and northwestern Gulf (3) counties, an area encompassing approximately 689 km² (265 sq mi) in the eastcentral Florida panhandle. The currently known sites are within an area bounded on the east by the lower Chipola River and lower Apalachicola River valleys, extending westward to Bear Creek and its tributaries which discharge to Econfina Creek in northcentral Bay County. All eleven sites are within the Gulf Coastal Lowlands physiographic region (see Brooks 1981; Puri & Vernon 1964), with seven occurring along major south flowing drainages and their tributaries (Sandy and Wetappo Creeks). Four sites occur on the southern portion of the Fountain Slope, the northernmost extension of the Gulf Coastal Lowlands.

Nearly all of the sites for *Eriocaulon nigrobracteatum* occur in mires on deep unstable sapric mucks of lower slope seepage fed herbaceous communities,

which are referred to in this paper as poor fens. Poor fens are oligotrophic to weakly minerotrophic, weakly ionic, somewhat acidic, nutrient deficient, mires which are poor in species of *Sphagnum*, (see Sjörs 1950, 1963). Although the term "poor fen" is prevalent in European wetland literature (Sjörs 1950), and in glaciated North American studies (Cooper 1990, 1991; Crum 1988; Glaser 1983, 1987; Sjörs 1959, 1963; Vitt *et al.* 1975; Wheeler *et al.* 1983; Windell *et al.* 1986), it has not been adopted in references to the vegetation of the southeastern United States coastal plain (except see Bridges & Orzell 1989, page 22). Poor fens of the Florida panhandle are known to the authors to occur along the middle and upper reaches of small stream valleys and their tributaries in the eastern part of the St. Andrews Bay drainage, within the western portion of the Apalachicola Embayment (see Schmidt 1984).

The occurrence of poor fens within the Gulf Coastal Lowlands of the Florida panhandle seems to be correlated with the escarpments of a series of Plio-Pleistocene sandy upland terraces. These coastal terraces reflect various relict shorelines (MacNeil 1950; Rupert 1991; Schmidt & Clark 1980) which, when dissected by perennial stream valleys, provide sufficient topographic relief to intercept groundwater stored in the unconsolidated surficial aquifer, forming poor fens. Although there are differences in the definitions and elevations of these terraces, due to their discontinuous nature and because past episodes of sea level fluctuations do not necessarily leave their remnants at a single elevation, there is a relationship between the ranges of elevations of these poor fens and those of commonly accepted relictual shoreline escarpments. Seven of the fens occur from 7-26 feet above sea level and seem to fall along the dissected escarpment of the Talbot terrace at the top of the Pamlico or Silver Bluff Terrace, at or near the Pamlico shoreline. One fen at 98-111 ft. is at the base of the Okefenokee (Sunderland) Terrace above the Wicomico terrace. The remaining three fens are from 140-160 ft. elevation and at the dissected margin of the Coharie (High Plio-Pleistocene) Terrace above the Okefenokee Terrace.

The surface soil of most of the poor fens is a black decomposed muck (pH 5.4-5.6), sometimes mixed with coarse sand. The depth of the muck layer varies from 30 cm (12 in) to at least 2.2 m (7 ft) and is autochthonous, having originated with the growth of the sedges, with little wood or *Sphagnum* moss present in the muck. One site on Wetappo Creek was underlain by a gray sandy clay layer at a depth of 30 to 45 cm. All other sites were underlain by coarse sand below the muck. The muck substrate is very fluid and contains large, water filled, vacuous channels, making determination of stratification extremely difficult. Soil surveys of these counties have not been conducted in sufficient detail to distinguish a specific poor fen soil type. The soils of these sites would probably be classified in the existing surveys as Rutlege (Typic Humaquepts), Pamlico (Terric Medisaprists), or Dorovan (Typic Medisaprists), with increasing depth of the organic surface. The Wetappo Creek site with the

clay substratum would probably be classified as a Pantego (Umbric Paleaquults), Rains (Typic Paleaquults), or Pelham (Arenic Paleaquults) soil.

Eriocaulon nigrobracteatum can be locally abundant in these poor fens, forming small clumps in habitats permanently saturated by telluric, weakly oligotrophic groundwater seepage on the sapric muck of unstable vegetation mats and in seep spring rivulets within the poor fens. The substrate surface is often covered with mats of an algal periphyton where there is shallow surface water due to a perched water table or associated with seep spring rivulets. Despite some minor floristic differences, the sites can be characterized as low stature herbaceous communities dependent upon the interaction of edaphic and hydrologic factors, and periodic low intensity ground fires, to prohibit succession toward a community dominated by woody species.

We have recorded a total of 172 vascular plants from these poor fens (see Appendix I). Of these, 67 were recorded as close associates of *Eriocaulon nigrobracteatum*; 20 of these 67 were recorded from four or more of the eleven known sites. Seven species of these poor fens are narrowly endemic to the Apalachicola Lowlands region in the Florida panhandle (*Gentiana pennelliana* Fernald, *Pinguicula ionantha* Godfrey, *Nyssa ursina* Small, *Oxypolis greenmanii* Mathias & Constance, *Physostegia godfreyi* Cantino, *Rudbeckia graminifolia* [Torr. & Gray] C.L. Boynt. & Beadle, *Verbesina chapmanii* J.R. Coleman), and nine additional species are endemic to the central East Gulf Coastal Plain (*Arnoglossum sulcatum* [Fern.] H. Robins., *Aster chapmanii* Torr. & Gray, *A. eryngiifolius* Torr. & Gray, *Hypericum chapmanii* P. Adams, *Myrica inodora* Bartr., *Panicum nudicaule* Vasey, *Pinguicula planifolia* Chapm., *Sarracenia leucophylla* Raf., *Xyris isoetifolia* Kral). Many other taxa of these communities have ranges centered in Florida, southern Georgia, and/or the outer East Gulf Coastal Plain of southern Alabama, southern Mississippi, and extreme southeastern Louisiana (see Appendix I). Ten species, 6% of the flora recorded at the sites, are currently under federal review for possible listing as federally protected plants and *Pinguicula ionantha* is currently proposed [Federal Register 57(168):39173-39174] for listing as federally threatened (see Appendix I). At one of the Bay County sites there are seven species of Eriocaulaceae (*Eriocaulon compressum*, *E. decangulare*, *E. nigrobracteatum*, *Lachnocaulon anceps* [Walt.] Morong, *L. digynum* Körn., *L. minus* [Chapm.] Small, and *Syngonanthus flavidulus* [Michx.] Ruhl.). These species along with *Eriocaulon texense*, *Eriocaulon lineare*, and *Lachnocaulon engleri* Ruhl., which we have collected elsewhere in Bay County, and *Lachnocaulon beyrichianum* Sporleider (*Godfrey* 64,203 [FSU]) represent the largest number of Eriocaulaceae recorded for any county in the United States.

Few other plants inhabiting the poor fens are at peak anthesis when *Eriocaulon nigrobracteatum* flowers: these include *Aronia arbutifolia* (L.) Pers., *Chaptalia tomentosa* Vent., *Cliftonia monophylla* (Lam.) Britt. ex Sarg., *Gaylussacia mosieri* Small, *Helenium vernale* Walt., *Pinguicula ionantha*, *P. plan-*

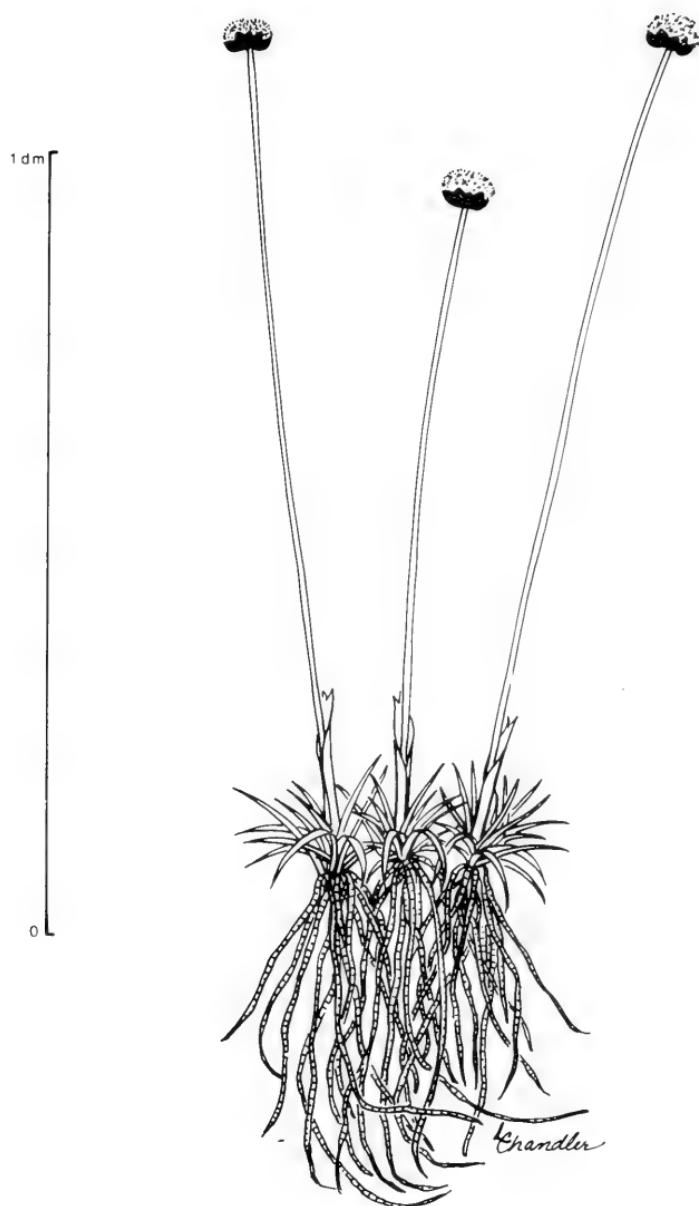


Figure 1: *Eriocaulon nigrobracteatum* Bridges & Orzell. Habit of plant.

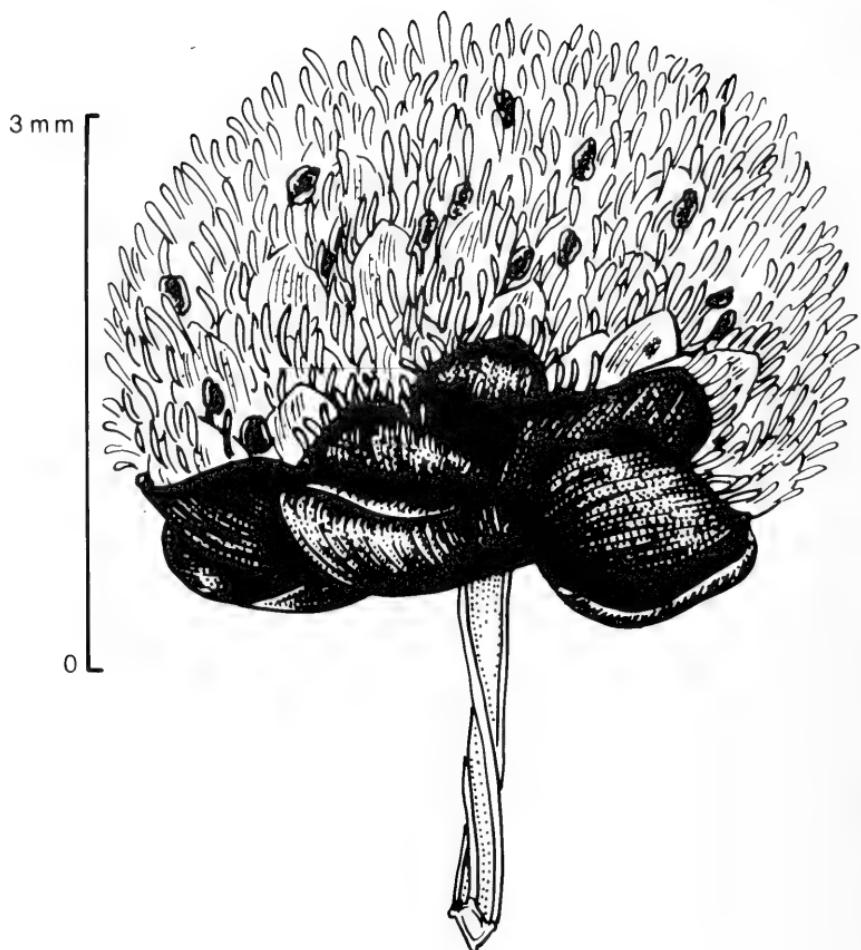


Figure 2: *Eriocaulon nigrobracteatum* Bridges & Orzell. Inflorescence.

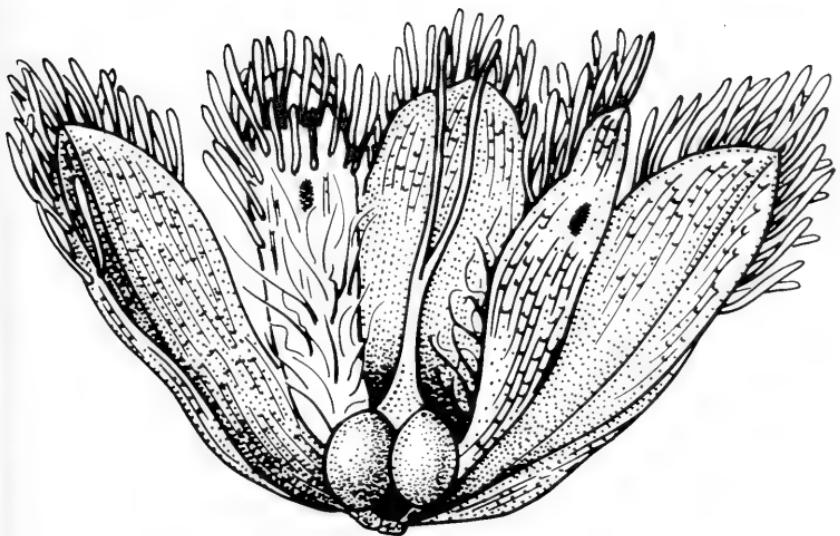
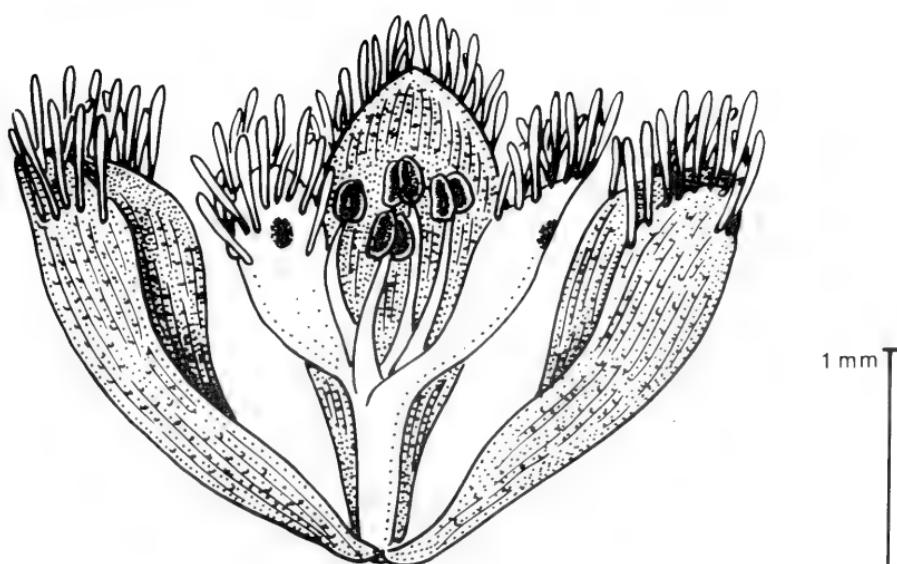


Figure 3: *Eriocaulon nigrobracteatum* Bridges & Orzell. Staminate flower (above); pistillate flower (below).

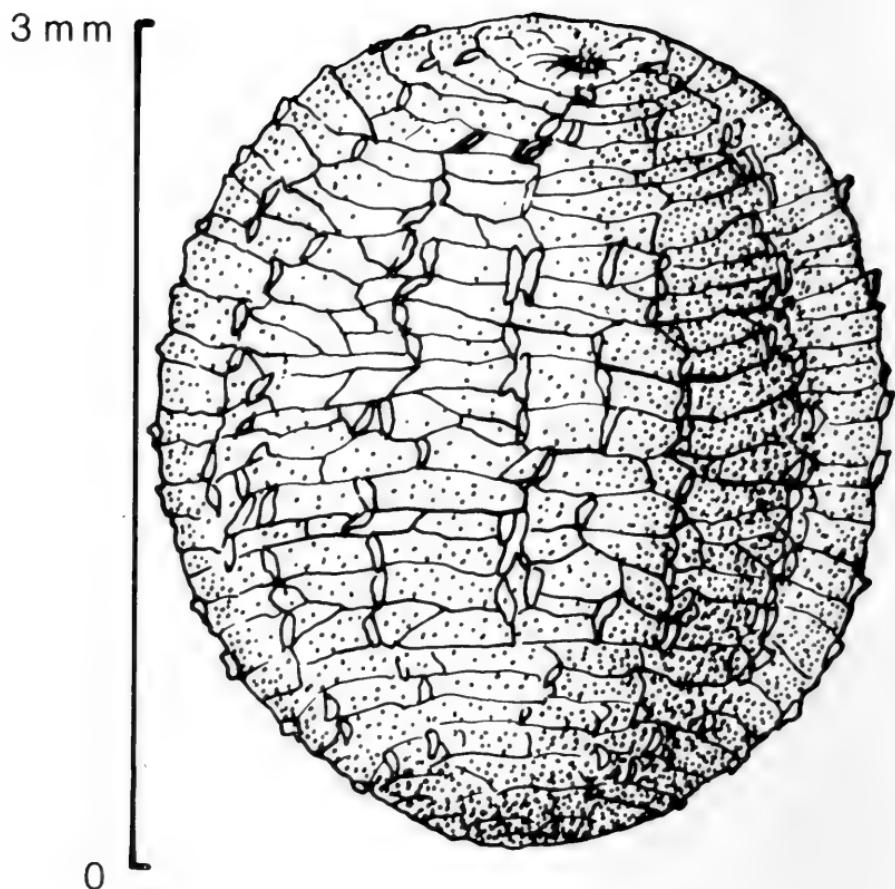


Figure 4: *Eriocaulon nigrobracteatum* Bridges & Orzell. Seed.

ifolia, and *Utricularia subulata* L. Other seepage plants such as *Eriocaulon compressum*, *Sarracenia flava* L., and *Syngonanthus flavidulus* are usually not in full anthesis, but rather in early flower or flower bud, when *E. nigrobracteatum* is in anthesis.

A total of twenty 0.5 m² plots were sampled in March 1992 within *Eriocaulon nigrobracteatum* populations. Ten plots were sampled at each of two sites. Percent vegetative cover by species was determined by species for each of plot, and the data were used to calculate frequency, total cover, and relative cover by species for each site and for both sites combined. The results (quantitative data are not presented, but are available upon request) show that the low statured herbaceous matrix of the sample plots is dominated, in almost equal proportions, by *Rhynchospora macra* (C.B. Clarke) Small, *R. stenophylla* Chapm. ex M.A. Curtis, *Panicum nudicaule*, *Pleea tenuifolia* Michx., *Eriocaulon compressum*, and *E. nigrobracteatum*. Additional species with significantly higher cover and/or frequency values than the remaining associates include (in order of importance) *Sarracenia psittacina* Michx., *Eriocaulon decangulare*, *Drosera capillaris* Poir., *D. tracyi* Macfarlane, *Hypericum brachyphyllum* (Spach) Steud., *Baldwina uniflora* Nutt., *Pinguicula planifolia*, *Syngonanthus flavidulus*, *Cliftonia monophylla*, *Aristida affinis* (Schultes) Kunth, and *Utricularia subulata*. Other unrecorded species may occur at similar frequencies in the sample plots but were undetected or underestimated due to the early vernal sampling date.

When comparing floristic and ecological data, one finds some interesting distinctions between the poor fens and that of floristically similar savannas and seepage bogs elsewhere in the Florida panhandle. Poor fens should not be confused with the nearly level, poorly drained ombrotrophic *Pleea* phase savannas described by Clewell (1971, 1981) and Wolfe *et al.* (1988) found primarily within the Apalachicola National Forest. *Aristida stricta* Michx., although present at many of the poor fens, does not form a continuous ground cover as it sometimes does in other herbaceous dominated seepage wetlands and savannas elsewhere in the southeastern United States. The poor fens differ in floristic composition from other seepage bogs in the region, particularly due to the high frequency and cover of the characteristic species *Eriocaulon nigrobracteatum*, *Rhynchospora stenophylla*, *R. macra*, *Pleea tenuifolia*, and *Panicum nudicaule*, whose combined ranges overlap only within the known range of *E. nigrobracteatum* in the eastcentral Florida panhandle. When the combined ranges of these characteristic species, except for *E. nigrobracteatum*, are considered, the area of overlap extends from the western Florida panhandle to adjacent southeastern Alabama (Baldwin County). The poor fen habitat of *E. nigrobracteatum* is a geographically restricted, floristically distinct, mire community type. The discovery of *Eriocaulon nigrobracteatum* and its poor fen habitat is indicative of the need for additional ecological and taxonomic studies involving the rich endemic flora of the Apalachicola Lowlands Region.

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APPENDIX I

Vascular plants vouchered at *Eriocaulon nigrobracteatum* sites, based upon repeated site visits made during the 1991 and 1992 growing seasons. The list does not represent a comprehensive vascular plant flora of the sites. Nomenclature follows Kartesz & Kartesz (1980), or in some cases Wunderlin & Hansen (1991). Plant taxa currently listed [Federal Register 55(35):6183-6229] under federal review for possible listing as either federally endangered or threatened species are indicated by (+) following the authority, or (PT) which indicates federally proposed for threatened status. Taxa with ranges centered (>95% of the known localities) in Florida, southern Georgia, and/or the outer East Gulf Coastal Plain of southern Alabama, southern Mississippi, and southeastern Louisiana are indicated by an (*). Plant taxa recorded as close associates of *Eriocaulon nigrobracteatum* are indicated by either (A) for those found at four or more sites or by (B) for those recorded from 1-3 sites.

Agalinis aphylla (Nutt.) Raf.
Aletris lutea Small *

Andropogon glomeratus (Walt.) B.S.P.
Anthaeenantia rufa (Ell.) Schultes
Aristida affinis (Schultes) Kunth (B)
Aristida stricta Michx. (B)
Arnoglossum ovatum (Walt.) H. Robins.
Arnoglossum sulcatum (Fern.) H. Robins. *
Aronia arbutifolia (L.) Pers.

Arundinaria tecta (Walt.) Muhl.
Asclepias connivens Baldw. ex Ell. *
Aster chapmanii Torr. & Gray + *
Aster eryngiifolius Torr. & Gray + *
Balduina uniflora Nutt. (A)
Bartonia paniculata (Michx.) Muhl.
Bartonia verna (Michx.) Raf. ex Barton
Bartonia virginica (L.) B.S.P.
Bidens mitis (Michx.) Sherff.
Bigelowia nudata (Michx.) DC. (B)
Burmannia capitata (Walt.) Mart.
Calopogon barbatus (Walt.) Ames
Calopogon tuberosus (L.) B.S.P.
Carex atlantica Bailey subsp. *atlantica*
Carex striata Michx.
Carphephorus pseudoliatris Cass. * (B)
Centella asiatica (L.) Urban
Chaptalia tomentosa Vent. (B)
Cirsium lecontei Torr. & Gray
Clethra alnifolia L.
Cliftonia monophylla (Lam.) Britt. ex Sarg. * (A)
Coreopsis linifolia Nutt. (B)
Coreopsis nudata Nutt. *
Ctenium aromaticum (Walt.) Wood (B)
Cyrilla racemiflora L. (B)
Dichanthelium scabriusculum (Ell.) Gould & C.A. Clark (B)
Drosera capillaris Poir. (A)
Drosera intermedia Hayne
Drosera tracyi Macfarlane * (A)
Dulichium arundinaceum (L.) Britt.
Eleocharis tuberculosa (Michx.) Roemer & Schultes (B)
Erigeron vernus (L.) Torr. & Gray
Eriocaulon compressum Lam. (A)
Eriocaulon decangulare L. (A)
Eriocaulon texense Körn.
Eryngium integrifolium Walt.
Eupatorium leucolepis (DC.) Torr. & Gray
Eupatorium pilosum Walt.
Eupatorium rotundifolium Walt.
Fuirena scirpoidea Michx.
Gaylussacia mosieri Small * (B)
Gentiana pennelliana Fernald *
Gratiola pilosa Michx.

Helenium vernale Walt. (A)
Helianthus angustifolius L.
Helianthus heterophyllum Nutt.
Hibiscus aculeatus Walt.
Hypericum brachyphyllum (Spach) Steud. * (A)
Hypericum chapmanii P. Adams * (B)
Hypericum cistifolium Lam.
Hypericum fasciculatum Lam. (B)
Hypericum nitidum Lam. *
Hypericum stans (Michx.) P. Adams & Robson
Ilex coriacea (Pursh) Chapm.
Ilex glabra (L.) A. Gray (B)
Ilex myrtifolia Walt.
Juncus debilis A. Gray
Juncus marginatus Rostk.
Juncus trigonocarpus Steud. (A)
Lachnanthes caroliniana (Lam.) Dandy
Lachnocalon anceps (Walt.) Morong
Lachnocalon digynum Körn. + (A)
Lachnocalon minus (Chapm.) Small
Liatris spicata (L.) Willd. (B)
Linum medium (Planch.) Britt. (B)
Lobelia floridana Chapm. *
Lobelia glandulosa Walt.
Lobelia puberula Michx. (B)
Lophiola aurea Ker-Gawl. * (B)
Lycopodiella alopecuroides (L.) Cranfill
Lycopodiella appressa (Chapm.) Cranfill
Lycopodiella caroliniana (L.) Pichi Sermolli (B)
Lycopodiella cernua (L.) Pichi Sermolli
Lycopodiella prostrata (Harper) Cranfill (B)
Lyonia lucida (Lam.) K. Koch
Magnolia virginiana L. (B)
Marshallia tenuifolia Raf.
Mitreola angustifolia (Torr. & Gray) J. Nelson
Mitreola sessilifolia (J.F. Gmelin) Torr. & Gray
Muhlenbergia capillaris (Lam.) Trin. var. *trichopodes* (Ell.) Vasey
Myrica cerifera L.
Myrica heterophylla Raf. (B)
Myrica inodora Bartr. *
Nyssa sylvatica Marsh. var. *biflora* (Walt.) Sarg.
Nyssa ursina Small * (B)
Oxypolis filiformis (Walt.) Britt. (B)

Oxypolis greenmanii Mathias & Constance * (B)
Panicum ensifolium Baldw. ex Ell.
Panicum nudicaule Vasey + * (A)
Peltandra sagittifolia (Michx.) Morong *
Persea palustris (Raf.) Sarg.
Physostegia godfreyi Cantino *
Pinckneya bracteata (Bartr.) Raf. *
Pinguicula ionantha Godfrey PT * (B)
Pinguicula lutea Walt.
Pinguicula planifolia Chapm. + * (A)
Pinus elliottii Engelm.
Pinus palustris P. Mill.
Pinus serotina Michx.
Platanthera blephariglottis (Willd.) Lindl.
Platanthera ciliaris (L.) Lindl.
Platanthera integra (Nutt.) A. Gray ex Beck
Platanthera nivea (Nutt.) Luer
Pleea tenuifolia Michx. (A)
Pogonia ophioglossoides (L.) Ker-Gawl. (B)
Polygala chapmanii Torr. & Gray *
Polygala cymosa Walt.
Polygala brevifolia Nutt. *
Polygala cruciata L. (B)
Polygala hookeri Torr. & Gray *
Polygala lutea L. (B)
Polygala ramosa Ell.
Rhexia alifanus Walt.
Rhexia lutea Walt.
Rhexia mariana L.
Rhexia petiolata Walt.
Rhododendron viscosum (L.) Torr.
Rhynchospora baldwinii A. Gray (B)
Rhynchospora cephalantha A. Gray
Rhynchospora chalarocephala Fern. & Gale (B)
Rhynchospora chapmanii M.A. Curtis (B)
Rhynchospora corniculata (Lam.) A. Gray (B)
Rhynchospora filifolia A. Gray
Rhynchospora gracilenta A. Gray (B)
Rhynchospora harperi Small *
Rhynchospora inundata (Oakes) Fern.
Rhynchospora latifolia (Baldw. ex Ell.) W. Thomas
Rhynchospora macra (C.B. Clarke) Small (A)
Rhynchospora oligantha A. Gray (B)

Rhynchospora plumosa Ell.

Rhynchospora stenophylla Chapm. ex M.A. Curtis (A)

Rudbeckia graminifolia (Torr. & Gray) C.L. Boynt. & Beadle * (B)

Sabatia bartramii Wilbur *

Sabatia campanulata (L.) Torr.

Sabatia macrophylla Hook. (A) *

Sarracenia flava L. (B)

Sarracenia leucophylla Raf. + * (B)

Sarracenia psittacina Michx. * (A)

Schoenolirion albiflorum (Raf.) R.R. Gates * (B)

Scleria baldwinii (Torr.) Steud. (B)

Scleria reticularis Michx.

Smilax laurifolia L. (B)

Smilax walteri Pursh

Solidago stricta Aiton

Spiranthes praecox (Walt.) S. Wats.

Stillingia aquatica Chapm. *

Syngonanthus flavidulus (Michx.) Ruhl. (A)

Taxodium ascendens Brongn. (B)

Tofieldia racemosa (Walt.) B.S.P. (B)

Utricularia juncea Vahl.

Utricularia subulata L. (A)

Verbesina chapmanii J.R. Coleman + *

Woodwardia areolata (L.) T. Moore

Woodwardia virginica (L.) J.E. Smith

Xyris ambigua Beyr. ex Kunth (B)

Xyris baldwiniana Schultes (A)

Xyris difformis Chapm. var. *curtissii* (Malme) Kral

Xyris drummondii Malme + (A)

Xyris fimbriata Ell.

Xyris isoetifolia Kral + * (B)

Xyris scabrifolia Harper + (B)

Xyris serotina Chapm. * (B)

Xyris stricta Chapm. *

DISTRIBUCION Y ECOLOGIA DE *PINUS JOHANNIS* M.-F. ROBERT

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ABSTRACT

A new population of *Pinus johannis* is described and compared with the type population.

KEY WORDS: *Pinus*, Pinaceae, México, taxonomy

RESUMEN

Se describe una nueva población de *Pinus johannis* y es comparada con la población tipo.

PALABRAS CLAVES: *Pinus*, Pinaceae, México, taxonomía

Pinus johannis M.-F. Robert fué descrito en el camino de Concepción del Oro a Mazapil, en el estado de Zacatecas ($24^{\circ} 37' N$, $101^{\circ} 28' O$) a una altura de 2700 metros sobre el nivel del mar. En 1983, Bailey & Hawksworth hicieron mención de *P. johannis* "in the cloud zone of some higher mountains of Coahuila and Sierra Madre Oriental" sin más; mientras en 1987 escribe que se encuentra en la Sierra de la Madera, Coahuila. Más recientemente, Perry (1991) presenta un mapa de distribución de este taxon donde aparecen tres sitios que son los siguientes: extremo norte de Zacatecas, oeste de Coahuila y sur de Nuevo León; en este ultimo *P. johannis* crece con *P. nelsonii* Shaw a una altura de 2800 metros. Por lo tanto después de su descripción no hubo más informaciones precisas.

Recientemente se encontró *Pinus johannis* en una nueva localidad, ubicada en el sureste del estado de Coahuila, en el Mpio. de Arteaga, en el

Cerro Coahuilón ($25^{\circ} 14' N$, $100^{\circ} 20' O$): octubre 1991, Abel García 1162 (CIDIIR,ENCB,MEXU).

Las poblaciones principales de *Pinus johannis* son localizadas en las faldas del Cerro, con pendientes suaves, a una altitud media de 2720 metros. Sin embargo, llegan individuos aislados hasta 2840 metros hasta los bosques de *Pseudotsuga menziesii* (Mayr) Franco, *Quercus hypoxantha* Trel., y *Q. greggii* Liebm., de suelos profundos, pero fuertemente afectados por disturbio antropogénico e incendios que han destruido en su totalidad el dosel superior conformado de *Pinus arizonica* Engelm. y *Pseudotsuga menziesii* muertos pero aún erectos, otros elementos herbáceos son frecuentes en el área como *Grindelia inuloides* Willd., *Hymenoxys insignis* (A. Gray) Cockerell, *Senecio coahuilensis* Greenm., *Senecio madrensis* A. Gray, *Stevia* spp., y *Penstemon* sp. El límite inferior de *Pinus johannis* alcanza los 2550 metros.

En la zona de su extensión máxima, *Pinus johannis* se encuentra en una vegetación tipo matorral de *Agave*, *Arctostaphylos*, *Ceanothus*, *Dasylyrion*, *Yucca*, con algunas herbáceas como: *Eupatorium*, *Penstemon*, y *Salvia*.

El suelo varía desde nulo en pleno afloramiento de roca madre hasta 40 cm de profundidad en la ecotónia con el bosque de *Pinus arizonica*, son evidentes algunas manchones de lutita. Presenta una efervescencia leve al HCl y un pH mediano de 7.7 o sea ligeramente alcalino.

En las poblaciones principales se ha notado que la regeneración de *Pinus johannis* es media, sin embargo podrían considerarse comunidades en peligro por estar en áreas muy cercanas a poblaciones con actividades antropogénicas como la agricultura y ganadería, a esto podrían sumarse los riesgos de incendio que son frecuentes en estas localidades.

Estas observaciones extienden hacia el este los sitios donde se conoce *Pinus johannis*. La nueva localidad se sitúa a la misma altitud que la del tipo. Las dos localidades difieren a nivel climático, las precipitaciones anuales medias del Cerro Coahuilón son un poco más elevadas, alrededor de 500 mm, la temperatura media se acerca a $16^{\circ}C$. La perturbación humana, más reciente que la que se nota en Puerto el Dique (Zac.), se traduce en explotación de la madera y ganadería extensiva. Se asume la posibilidad de la presencia de otras poblaciones de *P. johannis* que pudieran ligar geográficamente la población aislada del oeste de Coahuila con las del sureste.

AGRADECIMIENTOS

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NEW SPECIES OF *ECHEANDIA* (LILIACEAE) FROM OAXACA, MEXICO

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ABSTRACT

Twelve new species and seven new combinations in *Echeandia* (Liliaceae) are proposed. The new species are endemic to the states of Oaxaca and/or Puebla or Guerrero.

KEY WORDS: *Echeandia*, Liliaceae, México

The following new species and new combinations are proposed to aid the study of the flora of México, especially that of Oaxaca and adjacent states. Nine of the proposed species are endemic to Oaxaca and three occur in Oaxaca and adjacent Puebla or Guerrero.

***Echeandia conzattii* Cruden, sp. nov.** TYPE: MEXICO. Oaxaca: Lomas de las Sedas, Dist. Ella, 1950 m, 18 Oct 1933, Conzatti 4985 (HOLOTYPE: MO!; Isotype: US!).

Radicibus penaris ab cormo 4-6 cm, foliis basalibus anguste linearibus ciliatis, tepalis albis, antheris connatis 2.5-3.5 mm latis, filamentis squamosis.

Storage roots numerous, slender, most probably developing 4-6 cm from corm. Scape glabrous or scabrescent toward the base, 35-80 cm high, 0-3 branches. Basal leaves 4-6(-8), 27-67 cm long, 2-6 mm wide, papillate on veins on lower leaf surface, margin ciliate. Cauline leaves 2-4, the lower long apiculate. Tepals white, 10.5-13.5 mm long. Anthers connate, 4.5(-7) mm long, 2.0-3.5 mm wide. Filaments scaled, narrowly clavate, 4.5-6.0(-8.0) mm long. Ovaries 2.0-3.5 mm long. Capsules 8.5-11 mm long. In flower August-October.

Additional Specimens Examined: MEXICO. Guerrero: W of Taxco, between Casahuates and reservoir above town, 6200-6500 ft, 17 Aug 1948, Moore & Wood 4589 (MICH). Oaxaca: Type locality: 6000 ft, 1 Aug 1894, Pringle 5755 (GH); 8 Sept 1894, Smith 742 (MO,NY,US); Jayacatlán, 5000 ft, 10 Sept 1894, Smith 188 (GH); Cerro San Blas, Huaucilla, Dist. Nochixtlán, 2200 m, 14 Oct 1921, Conzatti 4274 (US).

The quite broad, open anther cone and the narrow basal leaves with papillae on the veins distinguish this species from other white flowered Mexican species.

***Echeandia smithii* Cruden, sp. nov.** TYPE: MEXICO. Oaxaca: ca. 3 km E Ixtlán de Juárez, ca. 2250 m, in oak woods with *Pinguicula*, *Coreopsis*, *Dahlia*, *Polypodium*, *Cuphea*, 24 Oct 1975, Cruden 2263 (HOLOTYPE: UC!; Isotypes: GH!, K!, MEXU!, US!).

Radicibus penaris juxta cormum, scapo glabro, foliis basalibus anguste linearis denticulatis 3-7, tepalis flavis, antheris connatis, filamentis squamosis.

Storage roots next to the corm, 1.5-3.0 cm long. Scape glabrous, 40-85 cm high, 0-1(-3) branches. Flower bearing nodes 4-9. Basal leaves 3-6(-7), narrowly linear, denticulate, 23-58 cm long, 2-4(-6) mm broad. Cauline leaves 2-4, lower 3-25 mm long. Tepals yellow, elliptic, 12-16 mm long, inner 5-6 mm wide, outer 2-3 mm wide. Anthers connate, 5.5-8.5 mm long, usually 2 mm longer than the filaments, tip of the cone 0.4-0.8(-1.2) mm in diameter and 1/5 to 1/2 the diameter of the cone. Filaments scaled, clavate, 4-5 mm long. Ovaries 4.5-6.0 mm long. In flower late August-early December. Chromosome number $n=8$ (Cruden 2263).

Additional Specimens Examined: MEXICO. Oaxaca: Sierra de San Felipe, 9000-10000 ft, Sep-Oct 1894, Smith 747 (F-2 sheets, MO, NY-2 sheets, US); Ixtlán de Juárez, E side of mountain, 2400 m, 6 Dec 1940, Krueger & Gillespie 42 (CAS, GH, LL, MO); Ruta 175, K 160, nr Ixtlán, 300-700 m(?), 28 Aug 1974, Conrad & Conrad 3171 (MO).

The narrowly linear leaves and strongly tapered anther cone, which is noticeably longer than the filaments, distinguish this species from other yellow flowered Mexican species with connate anthers and storage roots close to the corm.

***Echeandia vaginata* Cruden, sp. nov.** TYPE: MEXICO. Oaxaca: Ruta 190, K 132, ca. 40 km SE Nochixtlán, oak woods with *Dahlia*, *Cosmos*, *Tigridia*, *Cuphea*, *Salvia*, *Tradescantia*, *Donnellsmithia*, *Bouvardia*, ca. 2240 m, 6 Sep 1971, Cruden 1946 (HOLOTYPE: UC!; Isotypes: ENCB!, GH!, K!, MEXU!, MICH!, MO!, NY!, US!).

Radicibus penaris ab cormo (3-)7-10 cm, scapo pubescenti, foliis basalibus anguste ellipticis ciliatis ad bases undulatis 6-15 mm latis, tepalis flavis, antheris connatis, filamentis squamosis.

Storage roots (3-)7-10 cm from corm, 0.5-2.0 mm long. Scape pubescent, usually throughout, sometimes nearly glabrous, 46-80 cm high, 0-1 branches. Basal leaves 3-5, narrowly oblanceolate, margin ciliate to long ciliate and narrowly undulate toward the base, 17-32 cm long, 6-15 mm wide. Cauline leaves 2-3, ciliate. Tepals yellow, elliptic, 13.5-16.0 mm long, inner 6-8 mm wide, outer 3-4 mm wide. Pedicels 9-12(-14) mm long. Anthers 6-8 mm long, cone barrel shaped or weakly tapered, usually abruptly narrowed to the tip. Filaments of equal width throughout or somewhat wider in the middle, with short, narrow scales, 4.0-5.5 mm long. Ovaries 2.5-3.5 mm long. Capsules oblong, 8-10 mm long, 4 mm wide. In flower late June-early September. Chromosome number $n=8$ (*Cruden 1946*).

Additional Specimens Examined: MEXICO. Oaxaca: Ruta 190, K 494, ca. 20 km W of Huitzo, ca. 2150 m, 27 Jul 1968, *Cruden 1422* (ENCB, US); Mpio. Juchatengo, San Pedro Juchatengo, 1500 m, 13 Dec 1983, *Solheim, Benz, & Hallberg 1137* (WIS).

This is the only yellow flowered species of *Echeandia* with connate anthers that has a pubescent stem and relatively broad basal leaves that are long ciliate.

***Echeandia montealbanensis* Cruden, sp. nov.** TYPE: MEXICO. Oaxaca: Monte Albán, on the ruins, with *Agave*, *Spiranthes*, *Tradescantia*, ca. 1950 m, 5 Sep 1971, *Cruden 1944* (HOLOTYPE: UC!; Isotypes: ENCB!, F!, GH!, K!, MEXU!, MO!, NY!, US!).

Radicibus penaris ab cormo 5-8 cm, scapo scabro, foliis basalibus late linearibus 3-6, tepalis flavis, antheris libris, filamentis parvisquamosis.

Storage roots 2.5-5.0 cm long, 5-8 cm from corm. Scape strongly scabrous in lower half, less so above, 0.4-1.2 m high, 0-3(-6) branches. Basal leaves 3-6, broadly linear to oblanceolate, entire to short ciliate, 19-82 cm long, 12-26 mm wide. Cauline leaves (2-)3-4(-5), lower 8-35 cm long. Flowers yellow, facing outward, with the style passing below the stamens and bent upward near the apex. Tepals 9-13 mm long, inner 5.0-6.5 mm wide, outer 3 mm wide. Anthers 2.0-2.5(-3.0) mm long, rarely versatile, in most flowers the edges of the anther sacs reflexed and flattened against each other, thus holding the anthers in the same direction as the filaments. Filaments of equal width throughout, with small scales, inserted in an open depression, 4.0-6.0 mm long. Ovaries 2.0-3.5

mm long. Capsules oblong, 10.5-12.5 mm long, 4.5-6.0 mm wide. In flower mid July-mid October. Chromosome number $n=8$ (Cruden 1944).

Additional Specimens Examined: MEXICO. Oaxaca: Cerro de San Felipe, 2000 m, 1895, Conzatti 135 (GH); Almoloya, 14 Jul 1910, Rusby 143 (NY,US); Monte Albán: 27 Jul 1976, Willemse 46 (U); 20 Jul 1947, Conzatti, Rowell, & Barkley 17M395 (TEX); 89 km S Teotitlán, on road to Oaxaca, 1500 m, 10 Oct 1983, Anderson 12985 (MICH).

The pubescent scape, several caudine leaves, lightly scaled filaments, and nonversatile anthers distinguish this relatively robust species from the smaller *Echeandia vestita* (Baker) Cruden.

***Echeandia tenuifolia* Cruden, sp. nov.** TYPE: MEXICO. Oaxaca: Ruta 190, ca. 14 km SE Huajuapan de León, on dry hillside with various cacti, *Milla*, and *Compositae*, 1850 m, 11 Jul 1968, Cruden 1372 (HOLOTYPE: UC!; Isotypes: ENCB!, GH!, K!, MEXU!, MO!).

Radicibus penaris ab cormo 2-6 cm, scapo glabro vel ad basim scabrello, foliis basalibus anguste linearibus 1-2 mm latis, tepalis flavis, antheris libris, filamentis filiformis laevibus.

Storage roots 2-6 cm from the corm, 1-2 cm long. Scape glabrous or scabrellus near the base, 25-47 cm high, 0-2(-3) branches. Basal leaves narrowly linear, falcate, 5-20 cm long, 1-2 mm wide, margins entire to short ciliate. Cauline leaves 1-3, reduced to scarious bracts. Tepals yellow, (6-)8-10 mm long, inner (3.5-)4.0-5.5 mm wide, outer (1.5-)2.0-3.0 mm wide. Anthers free, versatile, (1.2-)1.5-2.5 mm long. Filaments filiform, smooth (1.9-)2.5-3.5 mm long, inserted in an open depression. Ovaries 1.25-1.75 mm long. In flower June-July. Chromosome number $n=8$ (Cruden 1372, 1531).

Additional Specimens Examined: MEXICO. Oaxaca: ca. 19 km SE Huajuapan de León, 1790 m, 17 June 1969, Cruden 1531 (ENCB, K, UC); 3.5 km NNE Magdalena Jicotlán, ca. 2150 m, 19 Jul 1968, Cruz C. 1874 (ENCB).

This species might be confused with the widespread *Echeandia flavescent* (Schultes & Schultes) Cruden, which has larger flowers, a noticeably larger ovary, and scaled filaments.

***Echeandia llanicola* Cruden, sp. nov.** TYPE: MEXICO. Oaxaca: wet meadow near the old Vivero Forestales, ca. 79 km ENE Oaxaca, ca. 2800 m, with *Eryngium*, *Ranunculus*, 15 Jul 1968, Cruden 1386 (HOLOTYPE: UC!; Isotypes: ENCB!, F!, GH!, K!, MEXU!, MICH!, MO!, NY!, US!).

Radicibus penaris juxta cormum, scapo glabro aramoso, foliis basalibus anguste ovatis ciliatis, floribus flavis solitariis 1-6, antheris libris vel connatis, filamentis squamosis.

Storage roots next to corm, 1-2(-3) cm long. Scape glabrous, unbranched, 4-24 cm high, bearing 1-4(-6) flowers. Basal leaves 6-10, falcate, narrowly ovate, 6-18 cm long, 5-11 mm wide, margins ciliate, Cauline leaves 0(-1), when present reduced to a bract. Bracts subtending the flowers entire, each subtending a single flower. Tepals yellow, elliptic, 12-15 mm long, inner 5.0-6.5 mm wide, 2.5-4.0 mm wide. Anthers free or connate, introrse, 2.2-3.2 mm long, curved toward the apex, not versatile, opposite or enclosing the stigma. Filaments of equal width throughout, scaled, 5-6(-7) mm long. Ovaries 2-4 mm long. Capsules oblong, 13-14 mm long, 4-5 mm wide. In flower July. Chromosome number $n=16$ (*Cruden 1384, 1986*).

Additional Specimens Examined: MEXICO. Oaxaca: Llano de las Flores, Ruta 175, ca. 82 km NE Oaxaca, ca. 2800 m, 15 Jul 1968, *Cruden 1384* (ENCB, GH, K, MEXU, MO, UC); 8 km SE Guacamaya, Mpio. Santiago-Teococuilco, 2600 m, 14 Jul 1985, *Rodriguez 133* (WIS).

The flat, nonfalcate leaves are reminiscent of some *Echeandia skinneri* (Baker) Cruden and *E. durangensis* (Greenman) Cruden. The former has pubescent scapes and smooth filaments and the leaf margins of the latter are denticulate to short ciliate rather than ciliate.

***Echeandia hallbergii* Cruden, sp. nov.** TYPE: MEXICO. Oaxaca: roadside ca. 3 km E Ixtlán de Juárez, with *Commelina*, *Tradescantia*, *Oxalis*, *Salvia*, under *Quercus*, ca. 2150 m, 14 Aug 1970, *Cruden 1764* (HOLOTYPE: UC!; Isotypes: ENCB!, F!, GH!, K!, MEXU!, MICH!, MO!, NY!, UC!, US!).

Radicibus penaris ab cormo 2-6 cm, scapo pubescenti, foliis basalibus anguste obovatis falcatis longiciliatis, tepalis flavis, antheris libris versatilis, filamentis laevibus vel paucisquamosis.

Storage roots (1.5-)2.5-5.0(-6.0) cm from corm, 1-2 cm long. Scapes 1-2 (-3) pubescent, at least near the base, 6-29(-37) cm high, unbranched. Basal leaves narrowly obovate, falcate, margin with long flat cilia, lower surface with scattered hairs or glabrous, 5-13(-23) cm long, (1.5-)3.0-12 mm wide, Cauline leaves 0(-1), when present reduced to a bract. Bracts subtending the flowers ciliate. Tepals elliptic, yellow, (9-)11-14 cm long, inner 5.0-6.5 mm wide, outer 2.5-4.0 mm wide. Anthers free, versatile, 1-2 mm long, twisted when open. Filaments slender, of equal width throughout, smooth or rarely with a few, small scales, (3.5-)4.5-6.0 mm long. Ovaries 2-4 mm long. Capsules subglobose, 6-8 mm long, 4-5 mm wide. In flower mid-June to July. Chromosome number $n=16$ (*Cruden 1378*) and $n=32$ (*Cruden 1764*).

Additional Specimens Examined: MEXICO. Oaxaca: Ruta 190, K 482-483, ca. 41 km SE Nochixtlán, ca. 2250 m, 12 Jul 1968, *Cruden 1378* (ENCB, GH,

K, MO, UC, US); Camino Montelobos, nr Pueblo Viejo, 2500 m, 22 Jun 1907, *Conzatti* 1903 (F, MEXU); Vivero Rancho Teja, ca. 3 mi E Ixtlán de Juárez, ca. 2150 m, 14 Jul 1968, Cruden 1382 (F, GH, K, MEXU, MO, NY, UC, US); above Vivero Rancho Teja, 2100-2200 m, 10 Jul 1973, McPherson 708 (MICH); 24 Jul 1973, McPherson 832 (MICH); Peñoles, 7500 ft, 1840, Galeotti 5369 (BR); Natividad Road NE of Oaxaca, 28 Jul 1947, Kenoyer 1605 (GH); Distr. de Ixtlán, 5 km NW el Cerejal, carretera Guelatao a las Animas, 2170 m, 29 Jul 1981, Trigos, Lorence, & Garcia 862A (MO).

The glabrous to nearly glabrous leaf surfaces distinguish *Echeandia hallbergii* from *E. vestita*, which has hirsute leaf surfaces.

***Echeandia parva* Cruden, sp. nov.** TYPE: MEXICO. Oaxaca: Ruta 190, palmwoodland, ca. 7.5 km NW Huajuapan de León, 1820 m, 14 Jul 1969, Cruden 1622 (HOLOTYPE: UC!; Isotypes: F!, GH!, K!, MEXU!, NY!, US!).

Radicibus penaris ab cormo 1-4 cm, scapo pubescenti, foliis basalibus linearibus longiciliatis apicibus recurvis infra papillosa, tepalis albis, antheris libris aversatilis, filamentis laevibus.

Storage roots 1-4 cm from corm, 1-2 cm long. Scapes 1-2, pubescent, 6-28 cm high, 0-1 branches. Basal leaves linear, strongly recurved toward the tip, margins long ciliate, veins on underside densely papillate, 6-20 cm long, 2-6 mm wide. Cauline leaves 0-1, reduced to a scarious bract. Tepals white, elliptic, 8-12 mm long, inner 4-5 mm wide, outer 2.5-3.5 mm wide. Anthers free, nonversatile 1.2-2.0 mm long. Filaments of equal width throughout, smooth, 3.5-5.5 mm long. Ovaries 1.5-2.0 mm long. Capsules subglobose, 4.5-7.0 mm long, 4.0-4.5 mm wide. In flower July. Chromosome number $n=8$ (Cruden 1367, 1622).

Additional Specimens Examined: MEXICO. Oaxaca: Ruta, 190, ca. 10 km NW of Huajuapan de León, 1850 m, 26 Jul 1968, Cruden 1415 (ASU, F, K, MEXU, MICH, MO, TEX, UC, WIS). Puebla: Ruta 190, 0.5-1.0 km NW Oaxaca border, 10 Jul 1968, Cruden 1367 (BM, CAS, ENCB, GH, MICH, MO, NY, UC, US); Chila-Zapotitlán, 15 Jul 1943, Miranda 2832 (MEXU).

This small white flowered species is known only from open palm woodlands NW of Huajuapan de León. The short, many flowered, pubescent scapes and long ciliate leaves with strongly recurved tips are distinctive.

***Echeandia confertiflora* Cruden, sp. nov.** TYPE: MEXICO. Oaxaca: Ruta 190, ca. 10 Km NW Huajuapan de León, palm woodland with *Nolina*, *Tigridia*, *Castilleja*, *Echeandia*, 1850 m, 11 July 1968, Cruden 1370 (HOLOTYPE: UC!).

Radicibus penaris ab cormo 4-8 cm, scapo pubescenti, foliis basalibus numerosis longiciliatis infra papillosa vel sparsem pubescentia, tepalis albis, antheris libris aversatilis, filamentis squamosis.

Storage roots 4 or more cm from base of scape, 1-3 cm long. Basal leaves numerous, long ciliate, veins on lower surface papillate or with scattered long hairs, glabrous above, 8-15 cm long, 2-6 mm wide. Scapes 1-2, approximately 30 cm high, pubescent, with 0-4 branches. Cauline leaves absent. Inflorescence bracts ciliate to long ciliate. Flowers white with brown veins, facing outward. Tepals elliptic, 10-11 mm long. Anthers 2.5 mm long, not versatile. Filaments scaled, 4.5-5.0 mm long. Ovaries 1.5-2.0 mm long. Capsules oblong, 9-10 mm long, 4-5 mm wide. In flower mid-June to mid-July.

Additional Specimen Examined: MEXICO. Oaxaca: 30 miles S Nochixtlán, 7500 ft, 1 Jul 1947, Johnston s.n. (TEX).

This species might be confused with the smaller *Echeandia parva*, which has smooth filaments and smaller capsules.

***Echeandia grandiflora* Cruden, sp. nov.** TYPE: MEXICO. Oaxaca: Ruta 190, K 110, ca. 32 km E Totolapan, steep hillside in *Pachycereus*, *Bursera* woodland, with *Oxalis*, *Lantana*, *Tradescantia*, other cacti, 800 m, specimen flowered in greenhouse 12 Nov 1976, Cruden 1762 (HOLOTYPE: UC!).

Radicibus penaris ab cormo 1-2 cm, scapo glabro, foliis basalibus anguste obovatis breve ciliatis, tepalis flavis, antheris libris versatilis, filamentis squamosis 11.0-13.5 mm longis.

Storage roots 1-2 cm from the corm, 2-3 cm long. Scape glabrous, to 75 cm high, 0-2 branches. Basal leaves narrowly obovate, 25-45 cm long, 11-25 mm wide, margin short ciliate. Cauline leaves 2-5, reduced upwards. Tepals yellow, elliptic, 16-21 mm long, inner 6-8 mm wide, outer 3.5-5.0 mm wide. Pedicels to 15 mm long in flower, to 21 mm long in fruit. Anthers free, versatile, 2-4 mm long. Filaments of equal width throughout, scaled, inserted in an open depression, 11.0-14.5 mm long. Ovaries (2.0-)3.5-5.0 mm long. Style bent upward at the tip. Capsules oblong, to 18 mm long and 5 mm wide, Chromosome number $n=8$ (Cruden 1762).

Additional Specimen Examined: MEXICO. Oaxaca: Ruta 190, 16-17 km W Tequisistlán, ca. 730 m, Cruden 1941 (ENCB), flowered in greenhouse.

The description of this species is based on plants that flowered in a greenhouse at the University of Iowa. The leaves of these were small compared to those of plants collected in the wild. It is quite likely the scapes are likewise reduced in size, and that plants encountered in the wild may be more robust than the description indicates. The caudine leaves, which dry white, and

the extremely long filaments are reminiscent of *Echeandia tenuis* (Weatherby) Cruden and *E. imbricata* Cruden, which have basal leaves that are 1-6 mm wide and smaller capsules.

***Echeandia oaxacana* Cruden, sp. nov.** TYPE: MEXICO. Oaxaca: Ruta 190, K 148-149, ca. 50 km WNW Tequisistlán, along stream in oak woods with *Commelina*, *Tradescantia*, ca. 1250 m, 4 Sep 1971, Cruden 1943 (HOLOTYPE: UC!; Isotypes: ENCB!, F!, GH!, K!, MEXU!, US!).

Radicibus penaris ab cormo 1-2 cm, scapo scabro prope basin, foliis basalibus anguste oblanceolatis breviciliolatis 3-5, tepalis albis, antheris connatis, filamentis squamosis.

Storage roots 1-2 cm from corm, 1.5-3.0 cm long. Scape scabrous toward the base, 60-95 cm high; branches 0-1(-2). Basal leaves 3-5, narrowly oblanceolate, 38-65 cm long, 6-12 mm wide, margins short ciliate. Cauline leaves 2-4, reduced to long narrow bracts. Flowers white, opening in late morning. Tepals narrowly elliptic, 11-14 mm long, inner 3-4 mm wide, outer 1.5-2.0 mm wide. Anthers connate, cone strongly tapered, usually longer than the filaments, 5.5-7.0 mm long. Filaments clavate, scaled, 5.5-6.0 mm long. Ovaries 3-4 mm long. Capsules oblong, 9-12 mm long, 5-6 mm wide. In flower August-September. Chromosome number $n=8$ (Cruden 1761).

Additional Specimens Examined: MEXICO. Oaxaca: Topotype, 13 Aug 1970, Cruden 1761 (NY, TEX, WIS).

The combination of white flowers, anther cone that is slightly longer than the filaments, scabrous scape, narrow basal leaves, and tightly clustered tubers, distinguishes this species from other Mexican species.

***Echeandia mirandae* Cruden, sp. nov.** TYPE: MEXICO. Oaxaca: 10.6 km NE Teotitlán del Camino on rd to Huautla de Jiménez, oak woods with cycads, cacti, *Agave*, *Castilleja*, *Commelina*, ca. 1790 m, 16 Aug 1970, Cruden 1774 (HOLOTYPE: UC!; Isotypes: ENCB!, F!, GH!, K!, MEXU!, MICH!, MO!, NY!, US!, WIS!).

Radicibus penaris ab cormo 3-15 cm, scapo scabro, foliis basalibus anguste oblanceolatis falcatis breviciliatis, tepalis albis, antheris libris aversatilis ad apices dehiscentes, filamentis paucisquamosis.

Root tubers 3-15 cm from corm, 1.5-3.5 cm long. Scape scabrous, 38-80 cm high, 0-6 branches. Basal leaves 5-10, narrowly oblanceolate, falcate, 12-40 cm long, 8-32 mm wide, margins short ciliate. Cauline leaves 1-3, reduced to

bracts. Flowers white, opening in late morning. Tepals 7-8 mm long, inner 3.0-3.5 mm wide, outer 1.5-2.0 mm wide. Anthers free, nonversatile, dehiscing through apical slits, 3-4 mm long. Filaments of equal width throughout, scaled, with a few weakly developed scales, or roughened, inserted in a pocket, 3-5 mm long. Ovaries 1.0-2.0(-2.5) mm long, Capsules oblong, 8-9 mm long, 5 mm wide. In flower June-August. Chromosome number $n=8$ (*Cruden 1362, 1774*).

Additional Specimens Examined: MEXICO. Puebla: Ruta 140, K 149-150, ca. 7 km SE Puebla-Morelos state line, ca. 1300 m, 10 Jul 1968, *Cruden 1362* (ENCB,F,GH,K,MEXU,MO,NY,TEX,UC,US); Amatitlán, NE Matamoros, 30 Jul 1942, *Miranda 2174* (GH).

This species might be confused with *Echeandia pihuamensis* Cruden, which has glabrous scapes and smooth filaments.

NEW COMBINATIONS

***Echeandia longifolia* (Weatherby) Cruden, stat. nov.** BASIONYM: *Echeandia macrophylla* Rosa var. *longifolia* Weatherby, Proc. Amer. Acad. Arts 38:391. 1910. TYPE: MEXICO. Oaxaca: vicinity of Choapan, 3800-4500 ft., 28-29 Jul 1894, *Nelson 910* (HOLOTYPE: US!; Isotype: US!).

***Echeandia echeandioides* (Schlechtendal) Cruden, comb. nov.** BASIONYM *Trachyandra echeandioides* Schlechtendal, Bot. Zeit. 3:629. 1845.

Echeandia eleutherandra K. Koch, Ind. Sem. Hort. Berol. App. 4 1861. TYPE: not examined. (not at B, destroyed?). *Anthericum eleutherandrum*(K. Koch) Moore. Gentes Herbarium 8:246. 1951.

Anthericum echeandioides Baker, Curtis' Bot. Mag. t. 6809. 1885. TYPE: Hort. Kew. Nov. 1883. (HOLOTYPE: K!).

***Echeandia michoacensis* (von Poellnitz) Cruden, comb. et stat. nov.** BASIONYM: *Anthericum platyphyllum* Greenman var. *michoacense* von Poellnitz, Rev. Sudamer. Bot. 7:158. 1943. TYPE: MEXICO. Michoacán: Punguato, vicinity of Morelia, 1950 m, 18 Aug 1910, *Arsène 5274* (LECTOTYPE: MO!; Isotypes: GH!,US!).

***Echeandia drepanoides* (Greenman) Cruden, comb. nov.** BASIONYM: *Anthericum drepanoides* Greenman, Proc. Amer. Acad. Arts 39:71. 1903. TYPE: MEXICO. Oaxaca: Sierra de San Felipe, 6000 ft, 6 Aug 1894, *Pringle 5757* (GH!).

***Echeandia platyphylla* (Greenman) Cruden, comb. nov.** BASIONYM: *Anthericum platyphyllum* Greenman, Proc. Amer. Acad. Arts 33:472. 1898.

TYPE: MEXICO. Puebla: dry limestone ledges, Tehuacán, 5000 ft, 29 Jul 1897, *Pringle* 6680 (HOLOTYPE: GH!; Isotypes: BM!, ENCB!, ISC!, MEXU!, MO!, NY!, UC!, US!).

Echeandia chandleri (Greenman & Thompson) Cruden, *comb. nov.* BASIONYM: *Anthericum chandleri* Greenman & Thompson, Ann. Missouri Bot. Gard. 1:405-406. 1914. TYPE: UNITED STATES. Texas: Cameron County: vicinity of Rio Hondo, Sep 1913, *Chandler* 7059 (MO!).

Echeandia tenuis (Weatherby) Cruden, *comb. nov.* BASIONYM: *Anthericum tenue* Weatherby, Proc. Amer. Acad. Arts 45:422. 1910. *Anthericum leptophyllum* Benth. var. *tenue* (Weatherby) von Poellnitz, Rev. Sudamer. Bot. 7:158. 1943. TYPE: MEXICO. Guerrero: between Ayusinapa and Petatlán, 5000-7000 ft, 14 Dec 1894, *Nelson* 2120 (US!).

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A NEW SCPOSE SPECIES OF *ACOURTIA* (ASTERACEAE, MUTISIEAE) FROM BELIZE

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ABSTRACT

A new scpose species of *Acourtia*, *A. belizeana* B.L. Turner, from the Mayan uplift of Belize is described and illustrated. It is closely related to the allopatric taxa *A. nudicaulis* and *A. hondurana*, neither of which is known to occur in Belize.

KEY WORDS: Asteraceae, Mutisieae, *Acourtia*, Belize

Routine identification of Central American and Mexican Asteraceae has revealed the following novelty.

Acourtia belizeana B.L. Turner, *sp. nov.* Figure 1. TYPE: BELIZE. Toledo District: "Lower part of Richardson Creek, affluent of Bladen Branch, lower part of Maya Mountains" (16°33'N, 88°47'W), 100-250 m, seepage area among boulders along stream in cracks of rocks, 2-11 Mar 1987, *Gerrit Davidse & Alan E. Brant* 31904 (HOLOTYPE: LL!; Isotypes: MO, US!).

Acourtiae honduranae B.L. Turner similis sed capitulescentia capitula numerosiora (8-20 vs. 3-8) ferentibus in pedunculis divaricatis longioribusque, involucris minoribus (6-7 mm altis vs. 8-10 mm), et acheniis sparsim hispidulis (vs. dense hispidis) setis pappi uniseriatis (vs. biseriatis) paucioribusque (40-50 vs. 80+) differt.

Scpose herbs 35-40 cm high. Scapes slender, glabrous. Leaves all basal, mostly 4-12 cm long, 1.5-2.5 cm wide; petioles 2-5 cm long, pilose with long hairs; blades ovate elliptic to elliptic, not at all lobed, sparsely pubescent, especially along the veins, the margins closely and coarsely serrate, sparsely

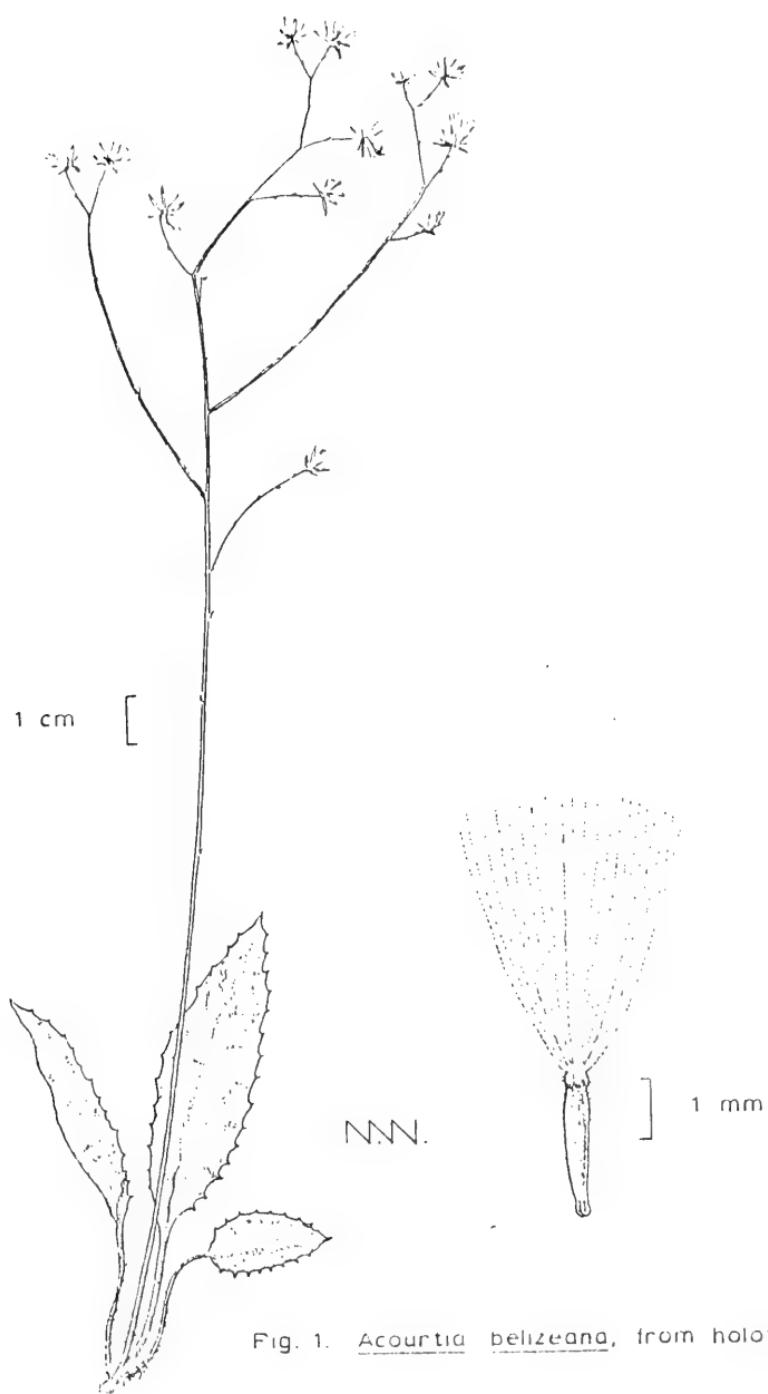


Fig. 1. *Acourtia belizeana*, from holotype.

pilose. Heads mostly 8-20 in very open paniculate cymes, the ultimate peduncles slender, glabrous, mostly 1-3 cm long. Involucres turbinate, 6-7 mm high, glabrous, the bracts 3-4 seriate, glabrous, the apices mostly obtuse or rounded. Receptacles plane, ca. 1.5 mm across, pubescent, the hairs ca. 0.25 mm long. Florets 8-10 per head, the corollas reportedly white, the tubes glabrous, ca. 2.5 mm long, the ligules 3-4 mm long, trilobed, the inner 2 lobelets 2-3 mm long. Achenes ca. 4 mm long, narrowly fusiform, 5 ribbed, bicolored, sparsely hispidulous, not at all glandular pubescent, the ribs yellowish, the faces purplish; pappus of a single series of ca. 50 tawny persistent bristles 5-6 mm long.

Acourtia belizeana is the only species of *Acourtia* known to occur in Belize. It is closely related to *A. hondurana* B.L. Turner. While both species bear similar narrowly elliptical unlobed leaves, *A. belizeana* has smaller involucres (6-7 mm high vs. 8-10 mm), heads on longer, more divaricate ultimate peduncles (mostly 1-3 cm long vs. 0.5-1.5 cm) and pappus of 40-50 bristles in a single series (vs. ca. 80+ in 2 series).

Cabrera (1993) included this taxon in her concept of *Acourtia hondurana* B.L. Turner, albeit separated out of *Acourtia* along with most other scapose elements as a new genus. I cannot subscribe in this instance to her specific concepts, nor to her newly proposed generic segregate.

Acourtia belizeana might also be compared with the more widespread *A. nudicaulis* (A. Gray) B.L. Turner, (maintained by Cabrera 1993), both having very similar capitulescences, but the latter has larger heads on shorter peduncles, more like those of *A. hondurana*, and its leaves are thinner, mostly larger, and lyrate lobed. In short, *A. belizeana* appears to be a localized endemic of the Mayan uplift in Belize, related to the closely allopatric *A. nudicaulis* and *A. hondurana*, but amply distinct, a repetitive speciation pattern found within *Acourtia* throughout Central America and México.

ACKNOWLEDGMENTS

I am grateful to Guy Nesom for the Latin diagnosis and to him and T.P. Ramamoorthy for reviewing the manuscript. Nancy Webber provided the illustration.

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**A NEW VARIETY OF *EPHEDRA TORREYANA* (EPHEDRACEAE) FROM
WEST TEXAS AND CHIHUAHUA, WITH NOTES ON HYBRIDIZATION IN
THE *E. TORREYANA* COMPLEX**

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ABSTRACT

Ephedra torreyana* var. *powelliorum is described as a new variety from the Río Conchos area of eastern Chihuahua, México, and the adjacent Big Bend area of Texas. Intergradation with the typical variety occurs in western Texas. *Ephedra torreyana* appears to be unusual among North American ephedras in its greater propensity for hybridization with other species, and this tendency must be taken into account in understanding the evolution of this complex.

KEY WORDS: *Ephedra*, Ephedraceae, Texas, Chihuahua, México, hybridization

RESUMEN

Ephedra torreyana* var. *powelliorum se describe como una variedad nueva, de la región del Río Conchos de Chihuahua y el área colindante del "Big Bend" de Texas. Se encuentra una zona de intergradación con la variedad típica en la parte occidental de Texas. Al parecer, *Ephedra torreyana* difiere de las demás especies norteamericanas del género por su propensión a la hibridación interespecífica, y hay que tomar en cuenta dicha tendencia para poder entender la evolución de este complejo de especies.

PALABRAS CLAVE: *Ephedra*, Ephedraceae, Texas, Chihuahua, México, hibridación

During the study of the species of *Ephedra* (Ephedraceae) of the Chihuahuan Desert for the preparation of a taxonomic treatment for the upcoming *Chihuahuan Desert Flora* (M.C. Johnston & J. Henrickson, eds.), a number of populations related to *E. torreyana* S. Watson were found to differ markedly in several respects from that species. These populations are here described as a new variety, and the justification for infraspecific rank is discussed, along with the apparent importance of hybridization in this complex.

***Ephedra torreyana* S. Watson var. *powelliorum* T. Wendt, var. nov.**

TYPE: MEXICO. Chihuahua: NE side of Sierra Cuchillo Parado, 29°35'N, 104°54'W, upper Cretaceous gypseous limestone outcrop, gypseous calcareous rocky soil, matorral desértico inerme of *Ephedra*, *Dasylinion*, *Acacia*, *Larrea*, *Fouquieria*, 950 m, 4 Apr 1973, M.C. Johnston, T.L. Wendt, & F. Chiang C. 10579 (♀) (HOLOTYPE: TEX!; Isotypes: MEXU, NY!).

Ephedra torreyana S. Watson var. *torreyana* similis sed seminibus non scabris, tubulo integumenti interioris 0.3-1.0 mm ab integumento exteriore exerto, antheris 2-6(-7) sessilibus differt.

Spreading, intricately branched low shrubs 0.3-0.8 m tall; branches divaricate with angle 50-90°, 1-several per node, mostly stout, straight, terete, to 4.5 mm thick in green (younger) portions, these younger portions dull gray green to medium olive green, usually glaucous, glabrous; longitudinal ridges rather irregular and often not strongly marked, 15-45 at bases of green portions, moderately asperous to usually smooth; stomata obscure to moderately prominent at 10×, present both in furrows and on ridges; internodes mostly 1.5-4.0 cm long; bark of older stems light to dark gray. Leaves 3 per node, 1.1-2.5 mm long, united 2/5-3/5 their length, the free portions ovate or deltate to lanceolate with apices rounded to acute, green to light brown in center with scarious margins often overlapping at base, the margins erose to ciliolate especially distally; basal leaves generally with relatively shorter free tips; sheaths soon splitting, leaving tattered pale gray remnants above the thin red-brown nodal line (old leaf bases rarely becoming swollen, black and persistent). Staminate cones 1-several per node, sessile or nearly so (scaly stipe to 1 mm), 4-7 mm long; bracts ternate (rarely binate distally), with 1-3 whorls of reduced sterile bracts at base and 2-7 whorls of fertile bracts, bracts of a whorl united at their bases; fertile bracts suborbicular above their fused bases, 1.5-2.5 mm long, pale red-brown, sometimes also greenish, with broad

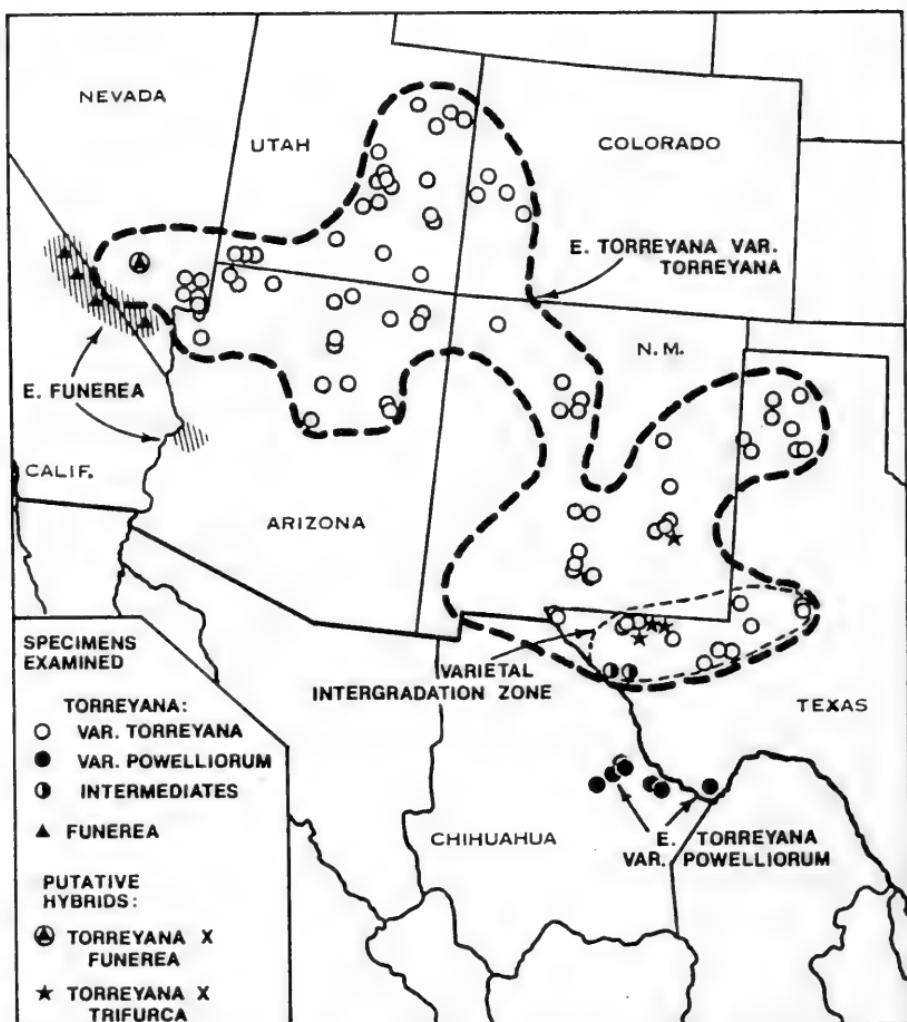
scariosus minutely erose margins; "perianth" 1.6-2.5 mm long, barely included to barely exserted from bract, flattened obovoid, sometimes very broadly so; staminal column 2.3-3.2 mm long, exserted from perianth 0.3-1.4 mm; stamens 2-6(-7), ovoid to obovoid, mostly 0.3-0.5 mm long, all sessile or occasionally with 1-few central ones on stipes to 0.2 mm long. Ovulate cones 1-several per node, 6-10 mm long, subsessile or borne on short scaly stalks to 3 mm long; bracts ternate, in 4-5 whorls (excluding 1-3[-4] whorls of extremely reduced basal/stalk bracts); distal (inner) bracts gradually larger; bracts of subdistal whorl 6.0-8.5 mm long, papery, strongly cymbiform, separate at base and clearly clawed (rarely almost clawless), the claw 1.5-3.0 mm long and 1.0-1.5 mm wide, the blade suborbicular-ovate, 4.5-6.5 mm long, 3.8-6.0 mm wide, the apex broadly rounded and sometimes lightly emarginate, the base broadly rounded or truncate, occasionally slightly cordate, margin minutely erose to strongly denticulate erose, claw and center of blade green to light red-brown, the rest hyaline and mostly very pale red-brown with the marginal 0.5-1.0 mm clear; seeds 1(-2) per cone, dark red-brown; mature seeds (rehydrated) lance pyriform, beaked, strongly 4 ridged longitudinally, square in cross-section, 7.5-8.5 mm long, 2.0-3.0 mm wide on a side near the base, mostly 2.3-4.0 times as long as wide, included to slightly exserted, surface smooth to lightly rugose at base (usually drying strongly so), otherwise smooth, glabrous; tubillus exserted 0.3-1.0 mm beyond end of outer integument.

DISTRIBUTION AND ECOLOGY: Apparently an obligate gypsophile, locally common in desert scrub on gravelly to fine grained gypseous soils at 850-1100 m elevation, in Big Bend National Park (Tornillo Flats), Texas, and in the lower Río Conchos valley and nearby drainages of eastern Chihuahua, México (Map 1).

ADDITIONAL SPECIMENS EXAMINED: MEXICO. Chihuahua: 16 mi S of Ojinaga on road to Camargo, 2 May 1973, H.S. Gentry & Engard 23198 (US); 10 mi S of Ojinaga, direct road from Ojinaga S to Alamos Chapo, 8 Aug 1940, I.M. Johnston & Muller 14 (sterile) (LL[2]); type locality, 4 Apr 1973, M.C. Johnston, Wendt, & Chiang 10578 (♂) (MEXU*, TEX, NY); 6 km E of Alamo Chapo Viejo on road to La Consolación, 1 May 1973, M.C. Johnston, Wendt, & Chiang 10746 (♀) (MEXU*, TEX), 10749 (♂) (MEXU*, TEX); 20 mi W of Ojinaga near Chih. highway 16, 7 Apr 1973, Powell, Turner, & Sikes 2472 (♀♂) (LL); 4.7 mi S then E from Falomir railroad bridge along road to Chilicote, 23 Mar 1975, Wendt & Lott 770 (♂) (TEX), 770A (♀) (TEX).

UNITED STATES. Texas: Brewster Co.: 6.9 mi N of Panther Junction, Big Bend National Park, 25 Apr 1987, Powell & Powell 5395a (♀) (SRSC); Tornillo Flats, Big Bend National Park, 5 Apr 1975, Warnock s.n. (♀) (TEX), Warnock s.n. (♂) (TEX). (*=fide H. Flores).

The name of the new variety honors Dr. A. Michael Powell and his wife Shirley Powell. Dr. Powell, author of *Trees & Shrubs of Trans-Pecos Texas* (1988) and many other botanical works, is director of the herbarium at Sul



MAP 1. Distribution of *Ephedra torreyana* varieties and related populations. Total distribution of var. *torreyana* based on Cutler (1939), Benson & Darrow (1981), Higgins (1987), and author's data; of *E. funerea*, Cutler (1939) and Butterwick (1989).

Ross State University and an authority on the woody flora of trans-Pecos Texas. Shirley Powell has accompanied him on many of his collecting trips in the area, and together they have collected critical specimens related to the present problem.

The new variety can be distinguished most easily from the typical variety by the following characters:

1. Ovules/seeds 1-3 per cone, mostly 2-3 on any one plant; seed surface scabrous with numerous minute prominent hard papillae, these often in rows; tubillus (distal part of inner integument) exserted (0.5-)0.8-3.0 mm beyond outer integument, almost always at least some >1.0 mm on any one plant; anthers (4-)5-8 per sporangiophore, mostly 6-7, the central and usually the lateral anthers on stipes 0.2-0.6 mm long, rarely all subsessile. var. *torreyana*
- 1' Ovules/seeds 1(-2) per cone, mostly or all 1 on any one plant; seed surface rugose at base but otherwise smooth; tubillus exserted 0.3-1.0 mm beyond outer integument; anthers 2-6(-7) per sporangiophore, mostly 3-5, all sessile or subsessile or occasionally the central ones on stipes to 0.2 mm long. var. *powelliiorum*

Variety *powelliiorum* also differs in its uniformly strongly divaricate branching and leaf bases which are only rarely persistent. In var. *torreyana*, there is a marked tendency toward more fastigiate plants with the leaf bases commonly becoming swollen, black, and persistent, although scattered plants throughout the range of the typical variety approach var. *powelliiorum* in these characters.

The differences listed above are strong ones within the context of the taxonomy of *Ephedra*, and the two varieties are more easily distinguished from each other than are some North American species of the genus (see Cutler's [1939] monograph). Nevertheless, study of the two varieties throughout their ranges (Map 1) reveals that the populations of var. *torreyana* geographically closest to those of var. *powelliiorum* show a marked tendency to display some of the characteristics of the latter variety, such as 1 seeded cones, nearly smooth seeds, or subsessile anthers. The area in which this tendency is marked within var. *torreyana* includes much of the northern trans-Pecos of Texas and the nearby high plains of that state (Map 1); these populations are referred to var. *torreyana* for convenience, but in some cases justifiably could be regarded as intermediates. Furthermore, a population near Sierra Blanca, Texas (listed below), of which only ovulate material is available, could be referred to var. *powelliiorum* except for the very lightly scabrous nature of the mature seeds; this population is referred to as an intermediate in Map 1. Given this pattern of variation, it seems reasonable, at least at present, to recognize the new taxon at the varietal level within *E. torreyana* (this being the infraspecific rank traditionally used within *Ephedra* in North America—see Cutler 1939, and Benson

& Darrow 1981). Nevertheless, the understanding of this pattern—and indeed of evolution within the *E. torreyana* complex—is complicated by the frequency with which this species hybridizes with other species of *Ephedra*, as discussed below.

It seems clear that previous authors have not been aware of the existence of the new variety largely due to its poor representation in herbarium collections. Cutler (1939) cited no collections referable to the new variety. Johnston (1943) referred a single Chihuahuan collection (*Johnston & Muller 14*) to *Ephedra torreyana* without comment, but the duplicates I have seen of this collection are sterile. Texas collections of the new variety postdate the publication of Correll & Johnston's (1970) flora of Texas. Valdés & Flores (1987), in their treatment of the gypsophilous and halophytic gymnosperms of México, referred several Mexican collections of the new variety to *E. torreyana*, based in part on an earlier manuscript of the treatment of the genus for the *Chihuahuan Desert Flora* by the present author. Powell (1988) referred all trans-Pecos material (including that from Brewster Co.) to *E. torreyana*, but he apparently saw only one specimen of the new variety (*Powell & Powell 5395a [SRSC]*). On this specimen he noted that it seemed to differ from other specimens of trans-Pecos *E. torreyana* in some characteristics. In addition, this one specimen is somewhat atypical of var. *powelli* (more exserted seeds, more scabrous stems, etc.), and may represent a product of hybridization with *E. aspera* S. Watson (see below), with which it was found growing.

Watson (1879) cited four syntypes in the description of *Ephedra torreyana*, of which Cutler (1939) chose *Wright 1883* in part (GH), from Fronteras, Texas (near El Paso) as the lectotype. *Wright 1883* comprises two separate collections and two species (*E. torreyana* and *E. aspera*), both from the same locality (Cutler 1939; Shaw 1987); *E. torreyana* material under this number is thus lectotype material. I have not seen the lectotype material at GH, but I have examined the apparent isolectotype collections at NY and US cited below. This, along with Watson's (1879) type description, Torrey's (1859) description of the Fronteras population and Parry's collections (cited below) from that area, clearly indicates that Watson's concept and material correspond to var. *torreyana* as here defined.

Of all species of North American *Ephedra*, *E. torreyana* seems to be the one most prone to hybridize with other species. Cutler (1939) reported only two apparent hybrids among the North American species, with *E. torreyana* being involved in both: $\times E. intermixta$ Cutler (= *E. torreyana* \times *E. trifurca* S. Watson) in New Mexico, and $\times E. arenicola$ Cutler (= *E. torreyana* X *E. coryi* E. Reed var. *viscida* Cutler [*E. cutleri* Peebles]) in Arizona. In the present study, I have found more evidence of hybridization involving *E. torreyana*:

1. A series of quite bizarre collections of *Ephedra* (cited below), previously identified as *E. torreyana*, has been made in northern Culberson Co. of west Texas (Map 1). These populations include not only the ovulate and staminate

plants typical of any population of ephedra, but also plants which produce only morphologically bisexual cones. No mature seeds and very little apparently fertile pollen was noted in these cones. I know of no other similar case in the genus—it is certainly extremely rare—and it may indicate an imbalance in the genomes of these populations, one cause of which could be hybridization. These populations are also characterized by the ovulate bracts having a narrow bright red-brown center sharply contrasting with a very broad scarious margin, suggesting the ovulate bracts of *E. trifurca*, while the shape and erose margins of these bracts are closer to *E. torreyana*. Further suggestion of the influence of *E. trifurca* is found in the leaves. The leaves of *E. torreyana* var. *torreyana* in Texas and New Mexico are rarely over 4 mm long, with ovate to lanceolate free tips rarely over 2 mm long. In the unusual Culberson Co. populations, leaves over 4 mm long are relatively common (to 7.5 mm), with free ovate to usually lance linear tips often 2.0-3.5(-5.5) mm long. In all of the characteristics, these plants approach the longer leaved *E. trifurca*. The origin of these populations through hybridization between *E. torreyana* and *E. trifurca* seems possible, even though they differ in many respects from the New Mexican hybrid between these species reported by Cutler (see above). Numerous collections from the area show these populations to be quite uniform morphologically, suggesting that even if they are ultimately the product of hybridization, they now represent a stabilized genome capable of transmission to progeny (although not necessarily via sexual reproduction). Further studies may support taxonomic rank for these populations. For the time being, their presence in the apparent zone of intergradation between the two varieties of *E. torreyana* complicates the interpretation of variation within that species in this area.

2. A collection from New Mexico (Chaves Co.: 2 mi SE of Roswell, Waterfall 7749 [NY]), while best referable to *Ephedra torreyana* by most characters, has leaf characteristics apparently intermediate to *E. trifurca* (leaves to 5.5 mm long with linear-lanceolate free tips to 3.5 mm long). It may represent another product of hybridization between these species or simply an extreme of variation. It is morphologically dissimilar to other apparent hybrids between these species discussed here.

3. There is clear evidence of hybridization between *Ephedra torreyana* var. *powelliorum* and *E. aspera*. The latter species is characterized by, among other things, leaves two per node with persistent leaf bases, ovulate bracts smaller and less scarious than in *E. torreyana*, and seeds round to rounded trigonous in cross section, mostly less than twice as long as wide, and well exserted from the cone (compare to description above). An ovulate collection from the type locality of *E. torreyana* var. *powelliorum*, near which *E. aspera* also occurs, is clearly intermediate: leaves two to three per node with persistent leaf bases, ovulate bracts in general similar to *E. aspera* but two to three ranked, seeds mostly strongly 4 ridged, ca. 2.5 times as long as wide, and intermediate in

exsertion (*M.C. Johnston, Wendt, & Chiang 10580 [TEX]*]).

4. The range of *Ephedra torreyana* var. *torreyana* is at least marginally sympatric with that of the related *E. funerea* Cov. & C. Morton in southern Nevada (Map 1). The two species remain for the most part quite distinct in that area. *Ephedra torreyana* in that part of its range is characterized by yellow, very scarious, strongly erose-denticulate ovulate bracts enclosing two to three very scabrous seeds, while *E. funerea* has yellow-red, thicker, minutely erose ovulate bracts enclosing a single smooth seed. However, collections from the Indian Springs area of Clark Co., Nevada (Map 1), are intermediate in these characters: yellow-red ovulate bracts intermediate in texture and margin characteristics, enclosing 1-3 scabrous to lightly scabrous seeds (with one often the predominant number). Unlike the case of the widespread varietal intergradation within *E. torreyana*, the intergradation between *E. torreyana* var. *torreyana* and *E. funerea* is apparent in one small area only and thus is not considered sufficient evidence to treat *E. funerea* as a variety of *E. torreyana*.

Ephedra torreyana seems to be unusual among ephedras in its tendency to hybridize with other species, although it may be that hybrids which involve this species are simply easier detect. In either case, the possible importance of hybridization in the origin of the patterns of variation and evolution in this complex cannot be ignored, and it is likely that a detailed biosystematic study of the complex with this in mind would be most rewarding.

OTHER MATERIAL EXAMINED FROM TRANS-PECOS TEXAS:

Ephedra torreyana var. *torreyana*: El Paso Co.: [Sand hills near Frontera, April 26, 1852, *fide* Shaw 1987], *Wright 1883* (in part) (Isolectotypes: NY (mixed with *E. aspera*), US); Frontera, Apr 1852, *Parry s.n.* (in part) (NY); near El Paso, Apr 1852, *Parry s.n.* (in part) (NY). Culberson Co.: along Pasotex pipeline, 23 mi E of Delaware Springs, *Correll & I.M. Johnston 22025* (LL,NY); West Dog Canyon, *Higgins 17610* (NY). Hudspeth Co.: 10 mi SE of Dell City, *Higgins 17544* (NY); ca. 12.5 mi E of Dell City, *Powell, Powell, & Weedin 2829* (LL,SRSC); along highway 62 at Salt Flats in "Culberson County" (*sic*), *Warnock 12191* (LL,SRSC[2]), *12192* (LL,SRSC[2]); 12.5 mi E of Dell City, *Worthington 11903* (NY). Reeves Co.: 9 mi E of Pecos at Toyah Lake, *Warnock 5299* (SRSC[2]).

Putative *torreyana/trifurca* hybrid populations from northern Culberson Co.: Rte. 84, 44 mi N of Van Horn, *Correll & I.M. Johnston 18466* (LL), *18470* (LL); N of Delaware Creek, *Correll & I.M. Johnston 19122* (LL); about 2.5 mi E of W end of Pasotex pipeline road, *Correll & Rollins 23914* (LL,SMU), *23915* (LL); 26 mi E of hwy. 62-180 along hwy. 652, *Higgins 6848* (NY); 2 mi SE of US routes 62 & 180 at New Mexico line, *McVaugh 8165* (SMU,SRSC,TEX[2]); 20 mi S of Whites City, ca. 2 mi E on state hwy. 1108 from U.S. 62, *Turner 5662* (TEX); 2 mi S of Texas-New Mexico line, N end of Rustler Hills, *Warnock*

5511 (LL,SMU,SRSC[2],TEX); 2 mi S of state line on road 1108, *Warnock & M.C. Johnston* 16320 (SRSC), 16352 (SRSC).

Intermediates between var. *torreyana* and var. *powelliorum*: Culberson Co.: 9 mi SW of Van Horn, *Waterfall* 4672 (sterile; putative intermediate based on location and vegetative morphology) (NY). Hudspeth Co.: 5 mi E of Sierra Blanca, *Warnock* 7784 (♀) (LL,SMU,SRSC).

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RACINAEA, A NEW GENUS OF BROMELIACEAE (TILLANDSIOIDEAE)

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ABSTRACT

A re-evaluation of *Tillandsia* subgenus *Pseudo-catopsis* (André) Baker revealed sufficiently distinct characters to warrant the establishment of a new genus, **Racinaea**. Named in honor of Racine Foster, *Racinaea* is described and discussed, and new combinations are provided for 46 species and 15 varieties.

KEY WORDS: Bromeliaceae, *Pseudo-catopsis*, *Racinaea*, *Tillandsia*

Tillandsia section *Pseudo-catopsis* was established by André in 1889. Shortly thereafter, Baker (1889) elevated *Pseudo-catopsis* to subgeneric rank. He characterized the group by having leaves rosulate, coriaceous, acuminate, and more or less densely lepidote, spikes distichous, flowers small, and a capsule 3-4 times the length of the sepals. Mez (1896), in his treatment of Bromeliaceae for C. DeCandolle's *Monoaraphiae Phanerogamarum*, accepted *Pseudo-catopsis* as a valid subgenus in *Tillandsia*, but did not accept all of Baker's descriptive characters. He redefined it by using both stamens that are shorter than the petals and asymmetric sepals as the relevant subgeneric characters. In doing so, he transferred several species out of subg. *Pseudo-catopsis* sensu Baker and into other subgenera in *Tillandsia*. Smith & Downs (1977) continued the use of *Pseudocatopsis* sensu Mez in their monograph of the Bromeliaceae, though they further defined it as having sepals broadest towards the apex.

During the course of revisionary work on the genera of Bromeliaceae, we have come to the conclusion that taxa treated under subgenus *Pseudocatopsis* are sufficiently distinct from other tillandsioid species to warrant generic segregation. We therefore establish the new genus *Racinaea* to accommodate them. The unique set of characters that readily distinguish *Racinaea* from other tillandsioid genera are distichous, small and inconspicuous flowers;

asymmetric sepals which are broadest towards the apex and free or nearly so; stamens and pistil that are included in the corolla; and a short and stout style. A generic description and appropriate new combinations for taxa previously treated as *Tillandsia* follow. It should be noted that *Tillandsia adpressa* André and its varieties, while belonging in *Racinaea*, are excluded from the present work because they are being treated separately elsewhere (Grant, in press).

The generic name is adopted in honor of the late Racine Foster (1910-1991) who, with her husband Mulford Foster, collected more than 200 new species of bromeliads, founded the Journal of the Bromeliad Society, and authored the book, *Brazil, Orchid of the Tropics*. She was a remarkable woman and her dedication to the study of bromeliads was an exemplary and lifelong endeavor. It gives us great pleasure to name our new genus after her.

Racinaea M.A. Spencer & L.B. Smith, *gen. nov.* TYPE: *Tillandsia cuspidata* L.B. Smith, *Phytologia* 9:252, pl. 3, figs. 7-8. 1963.

Tillandsia section *Pseudo-Catopsis* André, *Bromel. Andr.* 62, 66. 1889.

Tillandsia subgenus *Pseudo-Catopsis* (André) Baker, *Handb. Bromel.* 157, 192. 1889.

Herbae acaules vel caulescentes, epiphytiae. Folia rosulatum subpatentia vel subbulbosa. Vaginae amplae, aequales vel subinflatae. Laminae lingulatae vel subfiliformes. Scapus distinctus. Inflorescentia simplex vel composita, ramis distichis, rarissime leviter secundis. Flores hermaphroditici, actinomorphici, distichi vel raro secundi, sessiles vel brevissime pedicellati, inconspicui, omnibus minutis, saepissime pallidi vel lutescentes. Sepala convoluta, asymmetrica et fere ad apicem latiora, non ultra 15 mm longa, libera vel rarissime basi brevissime coalita. Petala libera, nuda, plus minusve patentia quam sepalis breviora vel longiora. Stamina et pistilla semper inclusa. Filamenta libera, quamquam interdum adnata ad petala. Ovarium optime superius, glaberrimum. Stylus subsessilis vel brevissimus et crassus, ovario brevior. Capsula septicide dehisces. Semina erecta, basi pilorum pappiformium sericantiumque seuto niveorum coma appendiculata.

Plants caulescent to short-caulescent, epiphytic. Leaves rosulate, open to subbulbous. Sheaths ample, even to subinflated. Blades ligulate to subfiliform. Scape distinct. Inflorescence simple or compound, branches distichous, rarely secund. Flowers hermaphroditic, actinomorphic, distichous to rarely secund, sessile to short pedicellate, small and inconspicuous, usually pale to yellow. Sepals convolute, asymmetric and broadest towards the apex, not more than 15 mm long, free to rarely short connate at base. Petals free, naked, more

or less spreading, shorter than to longer than the sepals. Stamens and pistil always included in the petals, sometimes deeply so. Filaments free, sometimes adnate to the petals. Ovary completely superior, glabrous. Style subsessile to short and stout, shorter than the ovary. Capsule septicidal, dehiscent. Seeds erect, basally appendaged with a white, pappiform coma.

Racinaea adscendens (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia adscendens* L.B. Smith, *North Am. Fl.* 19:122. 1938. TYPE: MEXICO. *Botteri* 1005 (HOLOTYPE: GH).

Racinaea aeris-incola (Mez) Spencer & Smith, *comb. nov.* BASIONYM: *Vriesea aerisincola* Mez in Martius, *Fl. Bras.* 3(3):555. 1894. TYPE: BRAZIL. *Lhotsky s.n.* (LECTOTYPE: G). *Tillandsia aeris-incola* (Mez) Mez in DC., *Monogr. Phan.* 9:759. 1896.

Racinaea blassii (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia blassii* L.B. Smith, *Phytologia* 22:85, pl. 1, fig. 5-6. 1971. TYPE: ECUADOR. *Hort. A. Blass* 4 (HOLOTYPE: US).

Racinaea commixa (Mez) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia commixa* Mez, *Repert. Sp. Nov.* 16:75. 1919. TYPE: PERU. *Mathews s.n.* (HOLOTYPE: K).

Racinaea contorta (Mez) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia contorta* Mez & Pittier ex Mez, *Bull. Herb. Boiss.*, II. 3:224. 1903. TYPE: COSTA RICA. *Tonduz* in *Herb. Costaric.* 11376 (HOLOTYPE: B).

Racinaea crispa (Baker) Spencer & Smith, *comb. nov.* BASIONYM: *Guzmania crispa* Baker, *Jour. Bot. London* 25:173. 1887. TYPE: COLOMBIA. *Purdie s.n.* (HOLOTYPE: K). *Tillandsia crispa* (Baker) Mez in DC., *Monogr. Phan.* 9:739. 1896.

Racinaea cuspidata (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia cuspidata* L.B. Smith, *Phytologia* 9:252, pl. 3, figs. 7-8. 1963. TYPE: PERU. *Wurdack* 1457 (HOLOTYPE: US; Isotype: USM).

Racinaea diffusa (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia diffusa* L.B. Smith, *Phytologia* 9:252, pl. 3, figs. 9-10. 1963. TYPE: PERU. *Wurdack* 1547 (HOLOTYPE: US).

Racinaea elegans (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia elegans* L.B. Smith, *Contr. U. S. Natl. Herb.* 29:528, fig. 84. 1954. TYPE: ECUADOR. *Drew* E-391 (HOLOTYPE: US).

Racinaea fawcettii (Mez) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia fawcettii* Mez in DC., *Monogr. Phan.* 9:752. 1896. TYPE: JAMAICA. *Harris in Fl. Jamaica* 5186 (HOLOTYPE: B; Isotype: GH).

Racinaea flexuosa (Baker) Spencer & Smith, *comb. nov.* BASIONYM: *Catopsis flexuosa* Baker, *Jour. Bot. London* 25:175. 1887. TYPE: BOLIVIA. *Mandon* 1172 (HOLOTYPE: K). *Tillandsia bakeri* L.B. Smith, *Contr. Gray Herb.* 95:45. 1931.

Racinaea fraseri (Baker) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia fraseri* Baker, *Handb. Bromel.* 187. 1889. TYPE: COLOMBIA or ECUADOR (without locality). *Fraser s.n.* (HOLOTYPE: BM).

Racinaea ghiesbreghtii (Baker) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia ghiesbreghtii* Baker, *Handb. Bromel.* 206. 1889. TYPE: MEXICO. *Ghiesbreght* 77 (HOLOTYPE: P).

Racinaea gilmartiniae (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia gilmartiniae* L.B. Smith, *Phytologia* 9:247, pl. 2, figs. 5-6. 1963. TYPE: ECUADOR. *Gilmartin* 799 (HOLOTYPE: US).

Racinaea homostachya (André) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia homostachya* André, *Enum. Bromel.* 7. 13 Dec. 1888; Rev. Hortic. 60:567. 16 Dec. 1888. TYPE: ECUADOR. André 3763 (HOLOTYPE: K).

Racinaea inconspicua (André) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia inconspicua* André, *Enum. Bromel.* 8. 13 Dec. 1888; Rev. Hortic. 60:568. 16 Dec. 1888. TYPE: ECUADOR. André 3795 (HOLOTYPE: K).

Racinaea insularis (Mez) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia insularis* Mez in DC., *Monogr. Phan.* 9:756. 1896. TYPE: ECUADOR. *Steindachner* 29 (HOLOTYPE: W).

Racinaea insularis (Mez) Spencer & Smith var. *latilamina* (Gilmartin) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia insularis* Mez var. *latilamina* Gilmartin, *Phytologia* 16:163. 1968. TYPE: ECUADOR. *Gilmartin & Hornman* 882 (HOLOTYPE: US).

Racinaea jenmanii (Baker) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia jenmanii* Baker, *Jour. Bot. London* 25:345. 1887. TYPE: GUYANA. *Jenman* 848 (HOLOTYPE: K; Isotype: BRG).

Racinaea laminata (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia laminata* L.B. Smith, *Phytologia* 9:253, pl. 3, figs. 11-12.

1963. TYPE: PERU. *Wurdack 1502* (HOLOTYPE: US; Isotype: USM).

Racinaea lescailliei (C. Wright) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia lescailliei* C. Wright in Sauvalle, Anal. Acad. Ci. Habana 8:53. 1871. TYPE: CUBA. *C. Wright 674* in part (HOLOTYPE: GH).

Racinaea membranacifolia (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia membranacifolia* L.B. Smith, Contr. Gray Herb. 89:11, 32, pl. 2, figs. 4-7. 1930. TYPE: COLOMBIA. *Killip & Smith 15067* (HOLOTYPE: GH; Isotypes: F, US).

Racinaea michelii (Mez) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia michelii* Mez, Bull. Herb. Boiss., II. 3:146. 1903. TYPE: COLOMBIA. *Langlassé 94* (HOLOTYPE: B; Isotypes: F, GH).

Racinaea monticola (Mez & Sodiro) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia monticola* Mez & Sodiro, Bull. Herb. Boiss., II. 4:1135. 1904. TYPE: ECUADOR. *Sodiro 171/33* (HOLOTYPE: B).

Racinaea multiflora (Bentham) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia multiflora* Bentham, Bot. Sulph. 174. 1844. TYPE: ECUADOR. *Cuming 1269* (HOLOTYPE: K).

Racinaea multiflora (Bentham) Spencer & Smith var. *decipiens* (André) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia decipiens* André, Enum. Bromel. 13 Dec. 1888; Rev. Hortic. 60:567. 16 Dec. 1888. TYPE: ECUADOR. *André 4055* (HOLOTYPE: K; Isotype: NY). *Tillandsia multiflora* Bentham var. *decipiens* (André) L.B. Smith, Contr. Gray Herb. 89:13, 35. 1930.

Racinaea multiflora (L.B. Smith) Spencer & Smith var. *tomensis* (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia multiflora* Bentham var. *tomensis* L.B. Smith, Contr. Gray Herb. 89:13, 35, pl. 5, figs. 1-4. 1930. TYPE: ECUADOR. *Hitchcock 21357* (HOLOTYPE: GH; Isotype: US).

Racinaea pallidoflavens (Mez) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia pallidoflavens* Mez, Repert. Nov. Sp. 3:36. 1906. TYPE: PERU. *Weberbauer 3298* (HOLOTYPE: B).

Racinaea pardina (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia pardina* L.B. Smith, Lilloa 14:98, figs. 15 & 16. 1948. TYPE: BOLIVIA. *Buchtien 7183* (HOLOTYPE: US).

Racinaea parviflora (Ruiz & Pavón) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia parviflora* Ruiz & Pavón, *Fl. Peruv.* 3:41, pl. 269. 1802. TYPE: PERU. Ruiz & Pavón s.n. (HOLOTYPE: BM).

Racinaea parviflora (Ruiz & Pavón) Spencer & Smith var. *expansa* (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia parviflora* Ruiz & Pavón var. *expansa* L.B. Smith, *Phytologia* 22:87, fig. 7. 1971. TYPE: ECUADOR. *Blass Hortus* 6 (HOLOTYPE: US).

Racinaea pectinata (André) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia pectinata* André, *Enum. Bromel.* 7. 13 Dec. 1888; *Rev. Hortic.* 60:567. 16 Dec. 1888. TYPE: ECUADOR. André 3032 (HOLOTYPE: K; Isotype: NY).

Racinaea pendulispica (Mez) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia pendulispica* Mez in DC., *Monogr. Phan.* 9:745. 1896. TYPE: PERU. Poeppig 1348 (HOLOTYPE: G; Isotype: W).

Racinaea penlandii (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia penlandii* L.B. Smith, *Lilloa* 6:384, pl. 1, figs. 14-15. 1941. TYPE: ECUADOR. Penland & Summers 1138 (HOLOTYPE: GH).

Racinaea penlandii (L.B. Smith) Spencer & Smith var. *pendunculata* (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia penlandii* L.B. Smith var. *pendunculata* L.B. Smith, *Lilloa* 6:385, pl. 1, figs. 16-17 1941. TYPE: COLOMBIA. Daniel & Tomas 1558 (HOLOTYPE: US).

Racinaea pugiformis (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia pugiformis* L.B. Smith, *Contr. Gray Herb.* 89:13, 24, pl. 1, figs. 4-7. 1930. TYPE: ECUADOR. Hitchcock 21586 (HOLOTYPE: GH; Isotype: US).

Racinaea quadripinnata (Mez & Sodiro) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia quadripinnata* Mez & Sodiro, *Bull. Herb. Boiss.*, II. 5:105. 1905. TYPE: ECUADOR. Sodiro 171/31 (HOLOTYPE: B).

Racinaea riocreuxii (André) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia riocreuxii* André, *Enum. Bromel.* 7. 13 Dec. 1888; *Rev. Hortic.* 60:567. 16 Dec. 1888. TYPE: ECUADOR. André 4408 (HOLOTYPE: K).

Racinaea ropalocarpa (André) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia ropalocarpa* André, *Enum. Bromel.* 6. 13 Dec. 1888; *Rev. Hortic.* 60:566. 16 Dec. 1888. TYPE: COLOMBIA. André 2319 (HOLOTYPE: K; Isotype: NY).

Racinaea rothschuhiana (Mez) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia rothschuhiana* Mez in DC., *Monogr. Phan.* 9:645. 1896. TYPE: NICARAGUA. *Rothschuh* 94 ("54") (HOLOTYPE: B).

Racinaea sanctae-martae (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia sanctae-martae* L.B. Smith, *Phytologia* 5:396, pl. 1, figs. 3-4. 1956. TYPE: COLOMBIA. *H.H. Smith* 2346 (HOLOTYPE: NY; Isotype: K).

Racinaea seemannii (Baker) Spencer & Smith, *comb. nov.* BASIONYM: *Guzmania seemannii* Baker, *Handb. Bromel.* 153. 1889. TYPE: ECUADOR. *Seemann* 898 (HOLOTYPE: K). *Tillandsia seemannii* (Baker) Mez in DC., *Monogr. Phan.* 9:737. 1896.

Racinaea sinuosa (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia sinuosa* L.B. Smith, *Contr. Gray Herb.* 89:14, 32, pl. 2, figs. 8-12. 1930. TYPE: ECUADOR. *Hitchcock* 21358 (HOLOTYPE: GH; Isotypes: NY, US).

Racinaea sinuosa (L.B. Smith) Spencer & Smith var. *quirozii* (Gilmartin) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia sinuosa* L.B. Smith var. *quirozii* Gilmartin, *Phytologia* 16:162. 1968. TYPE: ECUADOR. *Gilmartin* 1176 (HOLOTYPE: US).

Racinaea spiculosa (Grisebach) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia spiculosa* Grisebach, *Nachr. Ges. Wiss. Goett.* "1864":17. 1865. TYPE: VENEZUELA. *Fendler* 1518 (HOLOTYPE: GOET).

Racinaea spiculosa (Grisebach) Spencer & Smith var. *micrantha* (Baker) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia micrantha* Baker, *Jour. Bot. London* 25:303. 1887. TYPE: TRINIDAD. *Fendler* 818 (HOLOTYPE: K). *Tillandsia spiculosa* Grisebach var. *micrantha* (Baker) L.B. Smith, *Phytologia* 19:288. 1970.

Racinaea spiculosa (Grisebach) Spencer & Smith var. *stenoglossa* (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia stenoglossa* L.B. Smith, *Fieldiana Bot.* 28:151, fig. 23 g-h. 1951. TYPE: VENEZUELA. *Steyermark* 59775 (HOLOTYPE: F). *Tillandsia spiculosa* Grisebach var. *stenoglossa* (L.B. Smith) Gouda, *Bromeliaceae subf. Tillandsioideae. Flora of the Guianas* (Series A: *Phanerogams*, Fascicle 3):62. 1987.

Racinaea spiculosa (Grisebach) Spencer & Smith var. *ustulata* (Reitz) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia triticea* Burchell ex Baker var. *ustulata* Reitz, *Sellowia* 14:108. 1962. TYPE: BRAZIL. *Reitz* 5934 (HOLOTYPE: HBR).

Racinaea steyermarkii (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia steyermarkii* L.B. Smith, *Phytologia* 28:38, pl. 3, fig. I-K. 1974. TYPE: VENEZUELA. Steyermark, Espinoza, & Diederichs 106763 (HOLOTYPE: US; Isotype: VEN).

Racinaea subulata (André) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia subulata* André, *Enum. Bromel.* 7. 13 Dec. 1888; *Rev. Hortic.* 60:567. 16 Dec. 1888. TYPE: ECUADOR. André 9763 e.p. (HOLOTYPE: K).

Racinaea tandapiana (Luther) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia tandapiana* Luther, *Selbyana* 7(1):91-92, pl. 4. 1982. TYPE: ECUADOR. Wunderlin et al. 8651 (HOLOTYPE: SEL; Isotypes: UNA, USF).

Racinaea tenuispica (André) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia tenuispica* André, *Enum. Bromel.* 7. 13 Dec. 1888; *Rev. Hortic.* 60:567. 16 Dec. 1888. TYPE: COLOMBIA. André 2414 in part (HOLOTYPE: K).

Racinaea tetrantha (Ruiz & Pavón) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia tetrantha* Ruiz & Pavón, *Fl. Peruv.* 3:39, pl. 265. 1802. TYPE: PERU. Ruiz & Pavón s.n. (HOLOTYPE: MA).

Racinaea tetrantha (Ruiz & Pavón) Spencer & Smith var. *aurantiaca* (Grisebach) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia aurantiaca* Grisebach, *Nachr. Ges. Wiss. Goett.* "1864":16. 1865. TYPE: VENEZUELA. Fendler 2575 (HOLOTYPE: GOET). *Tillandsia tetrantha* Ruiz & Pavón var. *aurantiaca* (Grisebach) L.B. Smith, *Contr. Gray Herb.* 89:15. 1930.

Racinaea tetrantha (Ruiz & Pavón) Spencer & Smith var. *caribaea* (L.B. Smith) Spencer & Smith, *comb. nov.* BASIONYM: TYPE: VENEZUELA. Fendler 1529 (HOLOTYPE: GOET). *Tillandsia caribaea* L.B. Smith, *Proc. Amer. Acad. Arts* 70 (Contr. Gray Herb. 106):155. 1935; *Tillandsia tetrantha* Ruiz & Pavón var. *caribaea* (L.B. Smith) Gouda, *Bromeliaceae subf. Tillandsioideae. Flora of the Guianas* (Series A: Fascicle 3):65-66. 1987.

Racinaea tetrantha (Ruiz & Pavón) Spencer & Smith var. *densiflora* (André) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia aurantiaca* Grisebach var. *densiflora* André, *Enum. Bromel.* 7. 13 Dec. 1888; *Rev. Hortic.* 60:567. 16 Dec. 1888. TYPE: ECUADOR. André 2342 (HOLOTYPE: K; Isotype: NY). *Tillandsia tetrantha* Ruiz & Pavón var. *densiflora* (André) L.B. Smith, *Contr. Gray Herb.* 89:15. 1930.

Racinaea tetrantha (Ruiz & Pavón) Spencer & Smith var. *miniata* (André)

Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia aurantiaca* Grisebach var. *miniata* André, *Enum. Bromel.* 7. 13 Dec. 1888; Rev. Hortic. 60:567. 16 Dec. 1888. TYPE: COLOMBIA. André 3138 (HOLOTYPE: K; Isotype: NY). *Tillandsia tetrantha* Ruiz & Pavón var. *miniata* (André) L.B. Smith, *Contr. Gray Herb.* 89:15. 1930.

Racinaea tetrantha (Ruiz & Pavón) Spencer & Smith var. *ramosior* (L.B. Smith)

Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia tetrantha* Ruiz & Pavón var. *ramosior* L.B. Smith, *Phytologia* 13:147. 1966. TYPE: PERU. Hutchison & Wright 5669 (HOLOTYPE: US; Isotype: UC).

Racinaea tetrantha (Ruiz & Pavón) Spencer & Smith var. *scarlatina*

(André) Spencer & Smith, *comb. nov.* BASIONYM: *Tillandsia aurantiaca* Grisebach var. *scarlatina* André, *Enum. Bromel.* 7. 13 Dec. 1888; Rev. Hortic. 60:567. 16 Dec. 1888. TYPE: ECUADOR. André 3138 bis (HOLOTYPE: K; Isotype: NY). *Tillandsia tetrantha* Ruiz & Pavón var. *scarlatina* (André) L.B. Smith, *Contr. Gray Herb.* 89:15. 1930.

Racinaea trapeziformis (Mez) Spencer & Smith, *comb. nov.* BASIONYM:

Tillandsia trapeziformis Mez in DC., *Monogr. Phan.* 9:737. 1896. TYPE: COLOMBIA. Wagner s.n. (HOLOTYPE: Z; Isotype: B).

Racinaea tripinnata (Baker) Spencer & Smith, *comb. nov.* BASIONYM:

Catopsis tripinnata Baker, *Handb. Bromel.* 156. 1889. TYPE: ECUADOR. Pearce s.n. (HOLOTYPE: K). *Tillandsia tripinnata* (Baker) Mez in DC., *Monogr. Phan.* 9:745. 1896.

DUBIOUS TAXA

The following species probably belong in *Racinaea*, but, since we were unable to examine the types, and the descriptions did not include the relevant generic characters, they are impossible to place in *Racinaea* at this time.

Tillandsia almeriae Rauh, *Trop. und Subtrop. Pflanz.* 58:19-21, fig. 10. 1986.

Tillandsia domingosmartinis Rauh, *Trop. und Subtrop. Pflanz.* 79:17-18, fig. 8. 1991.

Tillandsia haugii Rauh, *Trop. und Subtrop. Pflanz.* 52:46-53. figs. 28-30. 1985.

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A NEW SPECIES OF *SENECIO* (ASTERACEAE) FROM NORTHERN COAHUILA, MEXICO

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ABSTRACT

A new species, *Senecio riskindii* B.L. Turner & T. Barkley, is described from northern Coahuila, México. It belongs to the *Triangularis* group of *Senecio* where it appears to relate to *S. lithophilus* Greenman.

KEY WORDS: Asteraceae, *Senecio*, México

Routine identification of Mexican Asteraceae has revealed the following novelty.

Senecio riskindii B. Turner & T. Barkley, sp. nov. TYPE: MEXICO. Coahuila: Mpio. de Villa Acuña, Serranías del Burro, Rancho El Bonito (ca. 29° 01' N, 102° 07' W), Canyon El Toro, calcareous soils in a shaded slope with *Quercus* spp., 18 Sep 1977, David H. Riskind 2123 (HOLOTYPE: TEX!; Isotype: MEXU).

Senecioni lithophilo Greenman similis sed plantis elatioribus (1.0-1.3 cm altis vs. 0.4-0.6 cm) et involucris majoribus (9-10 mm elatis vs. ca. 7 mm) differt.

Stiffly erect suffruticose simple stemmed annuals to ca. 1.3 m high. Stems persistently white tomentose, about equally leafy throughout. Leaves broadly lanceolate, sessile, clasping, those at midstem mostly 8-12 cm long, 2-4 cm wide, weakly pinnately nerved, persistently arachnoid tomentose beneath, glabrescent above, the margins serrate. Heads ca. 20, arranged in a terminal lax, flat topped bracteate cyme, the ultimate peduncles mostly 2-4 cm long. Involucres campanulate, the bracts ca. 23, uniseriate, mostly 9-10 mm long, glabrous at maturity except for the tufted apices, the calyxulus of 3-8 well defined linear, tomentose, bracts mostly 2-4 mm long. Ray florets ca. 13, pistillate, fertile, the ligules yellow, mostly 9-10 mm long, 2-3 mm wide, 4

nervate. Disk florets numerous, the corollas yellow, 7-8 mm long, glabrous, the tube 3-4 mm long, the lobes ca. 0.8 mm long. Anthers yellow. Style branches truncate, penicillate at the very apex. Achenes columnar, ca. 8 ribbed, pubescent throughout with papillose hairs, the pappus of numerous readily deciduous sparsely ciliate bristles 6-7 mm long.

This species presumably belongs to the *Triangulares* group of *Senecio* (sensu Barkley 1978). In Barkley's treatment of the *Triangularis* group for México (in prep.), *S. riskindii* will key to or near *S. lithophilus* Greenman, a poorly known species of southern Nuevo León. The latter is reportedly a cliff dwelling herb 40-60 cm high having smaller heads.

I forwarded type material of the present novelty to Dr. Barkley and he made the following notes after careful comparison with type material of *Senecio lithophilus*:

Senecio riskindii - principal involucral bracts 9-10 mm long; plant 10+ dm tall; stems arising singly from a taproot; stem more-or-less equally leafy throughout but the leaves on the lower third (or half) of the stem withering by flowering time; principal leaves "thinnish" in texture and with the evident secondary veins not notably parallel-arcuate.

Senecio lithophilus - principal involucral bracts mostly ca. 7 mm long; plant to 6 dm tall; stems more than 1 (2 on the type), arising from an apparently foreshortened caudex, the plant probably perennial; stem leafy throughout but the leaves on the lower half of the stem the largest, and persistent at flowering time; principal leaves apparently firm in texture, with at least some of the evident secondary veins parallel-arcuate.

By-and-large, the matter of persistent vs. early withering leaves on the lower half of the stem has some taxonomic distinction. Taproot vs. short caudex is useful but "negotiable," for many senecios with a caudex start life with a taproot, and then develop a caudex as the plant ages.

If the 2 specimens in-hand of *Senecio riskindii* and *S. lithophilus* were collected on the same hillside, I could imagine them as extremes of the same species; *S. riskindii* being a first year plant on a semishaded, well watered site, while *S. lithophilus* is a tough old survivor in a more open, drier place. With the limited materials, different habitats, and distant collection sites, however, I think that they are best regarded as quite separate species.

I am grateful to him for these reassuring observations and hence join his name with mine in proposing the species.

The species is named for its only known collector, David H. Riskind, biologist with the Texas Parks and Wildlife, Austin, Texas.

ACKNOWLEDGMENTS

I am grateful to Guy Nesom for the Latin diagnosis, and to him and Ted Barkley for reviewing the manuscript.

LITERATURE CITED

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TWO NEW SPECIES OF *POLIOMINTHA* (LAMIACEAE) FROM NORTHEASTERN MEXICO

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ABSTRACT

Two new species of *Poliomintha*, *P. bustamanta* B.L. Turner and *P. dendritica* B.L. Turner are described from Nuevo León and Coahuila, México, respectively. Both species belong to the sect. *Saturejoides* and both are closely related to *P. madrensis*. A key to the five species which compose the sect. *Saturejoides* is constructed, and their distributions in México are figured.

KEY WORDS: Lamiaceae, *Poliomintha*, México

Routine identification of plants from northern México has revealed the following novelties.

***Poliomintha bustamanta* B.L. Turner, sp. nov.** TYPE: MEXICO. Nuevo León: Bustamante, along mountain road to caves outside of Bustamante, 23 Jul 1988, Charles D. Peterson 1912 (HOLOTYPE: TEX).

Poliominthae madrensi Henr. similis sed paginis foliorum saepissime glabris (vs. glabrescentibus), calycibus 10.0-10.5 mm longis (vs. 12-14 mm), et calyce orificio annulo manifesto trichomatibus carenti (vs. annulus praesens) differt.

Brittle stemmed shrublets to 1 m (?) high. Stems tan, 4 sided, minutely reflexed hispidulous. Leaves ovate lanceolate to elliptic lanceolate, glabrous (except for occasional hispid hairs along the margins) mostly 10-14 mm long, 3-5 mm wide; petioles 2-3 mm long, tapering into the blade; blades very weakly pinnately nerved, if at all, densely glandular punctate on both surfaces, the margins entire. Flowers single in the upper leaf axils, the pedicels 1-3 mm long, minutely hispidulous. Calyx cylindric, 12-14 mm long, ca. 2 mm wide,

weakly 12-14 ribbed, glandular atomiferous throughout and very sparsely short pilose, the narrowly triangular lobes convergent, 2-3 mm long, pilose within, ± alike, the hairs appressed and not forming a distinct annulus (a ring of concentrated hairs at the orifice of the calyx). Corollas zygomorphic, 3-4 cm long, puberulent throughout, pale lavender (?), the upper lip ca. 2 mm long, the lower lip trilobed, ca. 4 mm long; fruit immature.

Irving (1972) recognized four species in his revision of *Poliomintha*: *P. longiflora* A. Gray and *P. glabrescens* A. Gray, belonging to the sect. *Saturejooides*; and *P. conjunctrix* Epling & Wiggins and *P. incana* (Torr.) A. Gray, belonging to the sect. *Poliomintha*. Henrickson (1979) added a fifth species, *P. madrensis* Henr., closely related to *P. longiflora*. The present species is closely related to *P. madrensis* but is readily distinguished by its glabrous leaves (from the start, not at all having young leaves with branched hairs), with longer petioles (ca. 1 mm long vs. 2-3 mm), longer calyces (12-14 mm long vs. 10.0-10.5 mm) with the annulus indistinct or absent.

***Poliomintha dendritica* B.L. Turner, sp. nov.** TYPE: MEXICO. Coahuila: 1.5 km NE Rancho de San Marcos, western edge of the Sierra de San Marcos ($26^{\circ} 49'N$, $102^{\circ} 07'-08'W$), 750-1400 m, occurring on limestone with *Agave lecheguilla*, etc., 12 Jun 1972, F. Chiang, T. Wendt, & M.C. Johnston 7676 (HOLOTYPE: TEX!).

Poliominthae madrensi Henr. similis sed foliis persistente signatim pubescentibus trichomatibus ramosis (vs. glabris), calycibus 6-7 mm longis annulo carentibus (vs. 10.0-10.5 mm longis annulo instructis, et corollis ca. 14 mm longis lavandulidis (vs. 30-35 mm longis purpureis) differt.

Much branched brittle stemmed shrublet to 1 m (?) high. Stems 4 sided, tan, markedly pubescent with mostly dendritic hairs. Leaves mostly 7-12 mm long, 3.5-5.0 mm wide; petioles ca. 1 mm long; blades elliptic, widest at or about the middle, glandular punctate, persistently pubescent on both surfaces with mostly dendritic hairs, the margins entire. Flowers single and axillary along the upper branches. Calyces cylindric, 6-7 mm long, 12-14 ribbed, glandular punctate, pubescent throughout with branched hairs, the narrowly triangular lobes ca. 2 mm long, convergent, pilose within, ± alike, the hairs not forming a distinct annulus. Corollas ca. 14 mm long, strongly zygomorphic, the tube ca. 8 mm long, pilose, pale lavender (?), the upper lip bilobed, ca. 2 mm long, the lower lip ca. 3 mm long, markedly trilobed, purple maculate along the lower throat. Anthers ca. 1 mm long, deep pink, widely divaricate. Fruits immature.

This taxon, because of its branched (dendritic) hairs, is presumably related to *Poliomintha madrensis*. Unlike the latter, however, the hairs are more



Figure 1. Distribution of *Poliomintha* sect. *Saturejoides* in México: *P. bustamanta* (open triangle), *P. dendritica* (target), *P. glabrescens* (open circles), *P. madrensis* (closed triangle), *P. longiflora* (closed circle).

numerous and persistent, the calyces smaller (6-7 mm long vs. 10.0-10.5 mm) and without a well defined annulus, the corollas pale lavender and only ca. 14 mm long (vs. purple and 30-35 mm long).

The five species belonging to the sect. *Saturejoides* can be readily identified by the following couplets:

1. Flowers arranged in axillary, 6 flowered cymes; corollas 13-15 mm long.
..... *P. glabrescens*
1. Flowers solitary in the leaf axils; corollas 15-40 mm long.(2)
 2. Young leaves glabrous from the start (except for a few minute marginal hispid hairs); calyces 12-14 mm long; annulus not developed. *P. bustamanta*
 2. Young leaves pubescent across their faces from the start; calyces 7-12 mm long; annulus well developed or absent.(3)
 3. Annulus well developed; leaves glabrescent; corollas purple. *P. madrensis*
 3. Annulus poorly defined or absent; leaves persistently pubescent; corollas pale lavender or orange red.(4)
 4. Foliage with dendritic hairs; corollas ca. 15 mm long. *P. dendritica*
 4. Foliage with appressed simple hairs; corollas 30-40 mm long.
..... *P. longiflora*

Distributions of the above taxa are shown in Figure 1. These are based upon records given by Irving (1972) and collections at LL, TEX assembled since.

ACKNOWLEDGMENTS

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Henrickson, J. 1982. A new species of *Poliomintha* (Lamiaceae) from the Chihuahuan Desert Region. *Sida* 9:290-292.

BOOKS RECEIVED

Fundamentals of Orchid Biology. Joseph Arditti. John Wiley & Sons, Inc., 605 Third Avenue, New York, New York 10158-0012. 1992. xii. 691 pp. Price unknown. ISBN 0-471-54906-1 (hardcover).

Intended as a textbook for orchid biology, this volume examines historical perspectives of orchid culture, orchid reproduction, and classification of orchids, as well as, evolution, cytology, physiology, phytochemistry, morphology, anatomy, mycorrhizal relationships, pollination, embryology, heredity, and ecology of orchids. The final chapter examines some of the commercial and ethnobotanical uses for orchids.

Green Plants, Their Origin and Diversity. Peter R. Bell. Dioscorides Press, 9999 S.W. Wilshire, Suite 124, Portland, Oregon 97225. 1992. 315 pp. \$39.95 (hardcover); \$24.95 (paper). ISBN 0-931146-20-8 (hardcover); 0-931146-23-2 (paper).

This book, illustrated with black and white photographs and line drawings, considers the evolution and relationships of all photosynthetic organisms. Included are the prokaryotic as well as eukaryotic forms. Evolutionary history, and evolutionary trends between and within groups are discussed throughout the book. The book will be a useful resource and/or textbook for plant morphology courses.

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Authors should arrange for two workers in the appropriate field to review the manuscript before submission. Copies of reviews should be forwarded to the editor with the manuscript. Manuscripts will not be published without review.

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